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EDITORIALS

ACCURACY IN RESEARCH . . . Man is an opinionated animal to whom there comes repeatedly the irresistible urge to express his ideas regarding a given subject of interest. The urge reflects a degree of intelligence, but the opinions may or may not corroborate this reflection; for opinions may result from a careful investigation and logical ordering of facts, or they may result from impressions that are not based upon proper investigation or logic.

Many who are sincerely disposed to be students of a subject, but who have not had sufficient opportunity to acquire information on the correct methods for study, are guilty of selecting evidence, the use of poor logic, and of various faulty omissions and commissions that serve to render practically valueless the product of their labors. Not infrequently reports are printed which include statements the absurdity of which is at once apparent to the qualified student of the subject. Such statements are subversive to the best interests of the pursuit of knowledge, and reflect anything but credit upon their authors. No one would knowingly be responsible for them.

The study of a subject such as archaeology can become profitable to the student and contributive to the development of the science only when directed by a correct scientific attitude and when employing correct scientific methods. These are available only as the result of training, whether that training be acquired scholastically or as the result of independent application to library, field and laboratory sources. The trained man gets results in archaeology just as truly as in any other branch of human activity.

It follows that every student of archaeology, no matter how experienced or inexperienced, will be continuously driven by his interest in the subject to improve his knowledge thereof and his ability to profitably participate in related investigations. The careful, critical inquiry into the facts or principles of a subject, for the purpose of augmenting

the store of available information, is known to science as "research." Only those statements based upon critical research under the directions of trained minds are worthy of recording and disseminating. All reports and theses are critically judged by fellow students on this basis, and the sincere student is his own most severe critic. W.C.M.

ETHNOS . . . A new *Ethnos* has entered the lists of anthropological periodicals, published bimonthly by the Ethnographical Museum of Sweden, Stockholm, in collaboration with Thule, Ltd., Publishers, and capably edited by Prof. A. Lindblom and Dr. S. Linné. To quote an editorial note in the first issue (Jan., 1936):

"*Ethnos* will devote itself primarily to Extra-European ethnology and archaeology. . . . Attention will also be paid to general questions of principle within the sphere of ethnology.

"The Journal is intended to be an organ of the Ethnographical Museum of Sweden and to be published for those Swedish anthropologists (in the widest sense of the word) who are working in the fields of research outside Europe. At the same time, however, the intention is—as will already be evident from the present number—that it shall be international in scope, and the publishers will therefore gladly welcome as collaborators any foreign research students irrespective of the anthropological 'school' to which they belong."

The journal, limited to 16 pages to the issue, is excellently presented, neatly printed on good paper and amply and well illustrated. The languages used are principally English, French and German. American archaeology and ethnology will hold a relatively important place in the subject matter presented.

The first two issues of *Ethnos* demonstrate not only that it deserves the support of American anthropological students, but that, in providing another of the too rare sources for the close coöperation of American and European anthropologists, it promises to render an important service in its chosen field of interest.

AMERICAN ANTIQUITY congratulates the editors of *Ethnos* upon the high quality manifested in the first two numbers of Volume I, and expresses the sincere hope that the new journal will meet with the success it deserves. W.C.M.

A CENTRAL TEXAS PUBLICATION . . . This spring the second Bulletin of the Central Texas Archeological Society of Waco, Texas was published in March. The first bulletin had appeared in the early spring

of 1935. These two attractive pamphlets reflect the untiring interest and activity of a rapidly growing Society in studying the history of the Indians who once lived in the vicinity of Waco. The first bulletin, of 32 pages, carries several articles describing the conditions of the region and the kinds of archaeological specimens obtained. The second bulletin, which bears the sub-title "Texas Centennial Issue," is a more pretentious volume of 96 pages. About one half of the issue is devoted to a series of articles dealing with finds made in Bell County, Texas, and particularly with material from a prehistoric shelter on Kell Branch. The 31 burials with their accompanying materials are discussed in some detail. The issue includes other articles on stone implements, pottery, and local surveys of interest to those studying this region.

This group of admittedly non-professional students is making a real effort to interpret the Indian history of its neighborhood. Perhaps a disproportionate emphasis is still being placed on the collection of specimens, but as the archaeological problems become more defined the value of archaeological associations in interpreting cultural relationships will become clearer. The articles which have so far appeared indicate that the group appreciates the value of geological relationships and proper field methods.

The Central Texas Archeological Society, and its editor, Frank H. Watt, of Waco, are to be congratulated upon this attractive and informative annual bulletin.

C.E.G.

SOUTHWESTERN LORE . . . In June of this year, the small magazine *Southwestern Lore* entered upon its second volume. It is the quarterly official publication of the Colorado Archaeological Society. Each of the 24-page issues which have so far appeared carries a series of articles on a variety of subjects, some by local Colorado non-professional students, others by such well-known students as Frank H. H. Roberts, Jr., E. B. Renaud, Lyndon L. Hargrave and Paul R. Franke. As one might expect, in the light of recent finds in that region, considerable attention is given to the problem of the antiquity of man in America.

The Society of which *Southwestern Lore* is the official publication is primarily interested in the archaeological problems within the state of Colorado. It seeks to reach all students of the subject. By establishing chapters in thirty-five Colorado cities, the Society has grown quickly, and is potentially able to exert great influence in encouraging proper

archaeological investigations and in eliminating as far as possible the destruction of evidence through ignorance of the problems involved. *Southwestern Lore* is an interesting magazine. Its editor is C. T. Hurst, Professor of Zoology and Dean of the Graduate School at Western State College, Gunnison, Colorado.

C.E.G.

POTTERY STUDY IN THE MAYA AREA[55]

MARY BUTLER[56]

PROBLEMS OF THE MAYA AREA

THE MAYA AREA is of outstanding archaeological importance because its early inhabitants achieved the highest civilization in pre-Columbian America. The early Maya and Mexicans surpassed other highly developed pre-Columbian American cultures because they possessed a form of writing and an intricate calendrical system. While the question of priority and derivation of culture in the Mexican-Maya area is still a moot one, there is no doubt that the Maya developed writing, representational art, and the sciences of mathematics and astronomy to a degree of excellence far beyond that attained by the Mexicans.

The Maya lived, before the Conquest as today, in Yucatan and the country south of it. We have little evidence concerning the archaic or earliest peoples of this region. We know that in the southern part there was such a cultural substratum, identified by modelled figurines and distinctive pottery. Since the Maya culture, while distinct from the Mexican, is even more distinct from the Central American, it is possible that the people who established it came from the north. Their languages form a separate stock, geographically isolated except for Huastec, an off-shoot of an early form of Maya found on the eastern coast of Mexico near Vera Cruz.

In the south, along the Usumacinta River, and in the low country northeast of it, lie the great stone cities, with carved and dated monuments, that belong to the first period of Maya power, called the Old Empire. The recorded dates cover a period of over six hundred years. They stop abruptly throughout the cities at about the beginning of Cycle 10 of Maya time, causing a gap in Maya history. We do not know whether there was a definite abandonment of southern cities for those

[55] This paper is not a comprehensive study of pottery work in the Maya area. It is a discussion of the importance of such work, and a consideration of some aspects of the methods used. It represents a section of the unpublished Introduction to the writer's report on *Piedras Negras Pottery* (Piedras Negras Preliminary Papers, No. 4, University Museum, Phila., 1935), which made the latter acceptable to the Anthropology Department of the University of Pennsylvania as a doctoral dissertation.

[56] American Section, University Museum, Philadelphia.

in the north, but we do know that Maya power had, by the beginning of the second millenium A.D., shifted into Yucatan, into stone cities better built than the earlier ones but lacking the carved, dated monuments. We have fragmentary historical accounts for this later period that tell us of the league, formed by the three most important cities, Chichen Itza, Uxmal, and Mayapan, that ruled the peninsula for two hundred years. About 1200 A.D., according to native records, the league was split by a conspiracy centering about Hunac Ceel, ruler of Mayapan. Hunac Ceel prevailed in the ensuing civil war, through the aid of Mexicans whom he called in from Xicalango (Campeche), and Mayapan ruled the Maya for the next two hundred years. Hunac Ceel gave Chichen Itza to his Mexican mercenaries as a reward, and Mexican influence was strong in Yucatan from that time. Toward the middle of the fifteenth century, the Maya revolted against the oppressive rule of Mayapan, and destroyed it utterly. After this, the country was ravaged by civil war, pestilence, and famine. The Maya were a broken people by the beginning of the sixteenth century.

The Old Empire was the Golden Age of Maya science and art. Writing had by this time progressed beyond the rebus stage to the use of symbols. Opinions vary as to whether these hieroglyphs were ideographic or phonetic in content. While attempts have been made to read them during the last thirty years, the only completely successful results have been those dealing with dates.

The calendrical system of the Maya must have evolved from centuries of astronomical observation of which we have no trace. During the Old Empire, dates were recorded in a count of the days elapsed since the day chosen as the beginning of time. Eighteen months of twenty days each, and an unlucky five-day nineteenth month, made up the year. Accurate record was kept both of the variation between this "vague year" and the solar year, and of a never-ending cycle of two hundred and sixty day periods, important for astrology. Supplementary, checking, lunar records were kept, and probably planetary ones as well, of Venus and perhaps Mercury. This calendar was more finely calibrated than any devised before our present Gregorian system, first adopted in the Christian world in the sixteenth century A.D. In the course of the mathematical calculations necessary for evolving their calendar, the Maya invented a symbol for zero, and discovered the principle of counting by position, using both long before they had been heard of in Europe. In the matter of science, we know that the later Maya of Yucatan were not as exact as their forebears. Instead of recording a date,

as in the Old Empire, by the number of days elapsed from the beginning of time, they merely assigned it to the *katun*, or twenty-year period, in which it occurred. Unless careful reckoning were kept, a *katun* name was capable of duplication every two hundred and fifty-six years.

In relief carving of human scenes on stone, whether limestone monoliths or small bits of jade, and on wood, shell, or pottery, and in painting men and animals on pottery and frescoes, the Maya were outstanding in pre-Columbia America. Relief carving from the Old Empire is unexcelled by the early art of any people. In the later Yucatecan period, emphasis shifted from sculpture to architecture, and relief carving was almost entirely confined to building façades. Examples portraying human beings are artistically inferior to Old Empire work.

The Maya never produced effigy portrait pottery as fine as that of the Chimu in South America, but their mold-made figurines of the Old Empire period equalled their sculpture in artistic quality. These are found at the beginning of the Yucatecan period, but disappear about 1200 A.D.

Examples of Old Empire mural painting have all been destroyed, but a comparison of the styles of the three surviving Maya codices shows that the Dresden Codex, thought to be the earliest, is also the finest. This is a slightly specious argument, since the reason for thinking it early is its stylistic resemblance to Old Empire art. However, it suggests that the same distinction between the two periods applied to painting as well as sculpture.

We do not know what comparison could be made between the two periods in regard to social and political life, since our knowledge of these is confined to Yucatan, but there is no doubt that the Maya of the Old Empire led early America in the matter of representational art and mathematical science. In spite of the high state of civilization in Mexico, Mexican writing never developed beyond a rebus system; the Mexican calendar was a simplified form of the Maya one; and their art did not equal that of the Maya, although they were excellent metal-workers. Their genius was, to a large extent, political.

Maya civilization cannot be properly evaluated unless considered in its relation to the civilizations of early Mexico, for the Maya and Mexicans, though linguistically distinct, were culturally interrelated.

Presumably the earliest peoples in the Mexican-Maya area were nomadic hunters, but no traces of such a population have yet been found. The earliest peoples of whom we know were agriculturalists, identified by clever, crude, modelled figurines and by distinctive pot-

tery. At first, this level, called "Archaic," was supposed to have been roughly contemporaneous from Mexico to Peru, and to represent dissemination from the Valley of Mexico of agriculture, pottery and figurine-making. Archaeological investigations in Central America revealed "Archaic" remains that have been assigned to the second millenium B.C. In Mexico the "Archaic" was found to have been not one culture, but a series of cultures; and study of "Archaic" objects showed that the people who made them were fairly advanced culturally, and not necessarily the domesticators of maize and discoverers of New World agriculture. They must have been living a sedentary life for centuries in order to have developed the arts and crafts reflected in the pottery, figurines, and spindle-whorls. In the Mexican-Maya area they can still be called archaic, since they are the earliest people known there. We do not know their language, nor when they first appeared.

Little is known at present of early peoples in northern Mexico. What work has been done there suggests a division north of the Valley of Mexico between the high civilizations developed in the Valley and the more primitive tribes to the north. At present there is a definite cultural gap between the civilizations of the Valley of Mexico and the Pueblo cultures in the southwestern United States. Presumably the successive waves of dominant peoples in the Valley of Mexico came from farther north, since all those of whom we have record spoke Nahua languages, part of the Uto-Aztecan stock that extends as far north as Montana.

In the Valley of Mexico, the next culture after the "Archaic" is called the Toltec, and is identified by mold-made figurines and distinctive pottery. Legend says that the Toltecs, a Nahua-speaking people, founded a great empire, and developed the arts and sciences to a high degree. According to legendary sources, Quetzalcoatl, worshipped as a god, was also a Toltec king whose reign marked the Mexican Golden Age, when everyone was rich and happy, and even the cotton grew in the fields already colored red, blue, and yellow. The tale of the overthrow of Quetzalcoatl by three sorcerers from the north, Titlacaoan (Tezcatlipoca), Uitzilopochtli, and Tlacabepan, symbolizes the downfall of the Toltec power under the attacks of the fierce Chichimec Nahua-speaking hunters from the north. It is said that Tula, the Toltec capital, tentatively identified with the site of Teotihuacan, fell at about the end of the twelfth century A.D., and that bands of Toltec warriors pushed south and founded Nahua colonies in Salvador, Nicaragua, and Panama, and also in Campeche and Yucatan.

The Aztecs, a small, Nahua-speaking tribe, finally surged to the political top and established a feudal state that eventually held most of Mexico in subjugation. Their power was at its height when Cortez landed in 1519.

In the south of Mexico, in the Valley of Oaxaca, lived the Mixtecs and the Zapotecs. At the time of the Conquest, they were a highly civilized group linguistically distinct from the Aztecs, who tried in vain to conquer them. We do not know how long they had flourished, nor what people preceded them. Their culture was Mexican with evidences of Maya contact.

At the southeastern boundary of the Maya territory is to be found a sharp cultural break similar to that encountered in northern Mexico. Mexican-Maya culture stops, and Central American cultures start.

Probably the outstanding problem of the Mexican-Maya area is the question of the interrelation of cultures. Geographically the Maya area is peripheral to the Mexican; culturally the positions may well have been reversed. The Aztecs, and the Zapotecs and Mixtecs had simpler forms of writing and of the calendar than those developed by the Maya. We do not know whether these resulted from contact with the Maya, or whether the Maya forms of writing and the calendar were specialized developments of systems common to all Middle America at an earlier time level. The question hinges, to a large extent, on the point of the correlation of the Maya and Christian calendars. If either the Spinden or the Goodman-Thompson correlations of Maya and Christian calendars is correct, and the historical accounts of the Toltecs can be considered accurate, Maya artistic and scientific development probably preceded that in Mexico. Spinden's correlation places the Old Empire period of Maya history in the first six hundred years of the Christian era, while Goodman and Thompson place it two hundred and sixty years later. The Toltecs are believed to have come into power about 700 A.D. This would mean that cultural traits common to the Maya and the Mexicans were probably originated by the former. However, archaeologists at present tend to place the Toltecs earlier and the Maya later, due to the intensive pottery study that has been conducted in both areas. This would mean that the early Maya and the Toltecs were building their cities at the same time, or perhaps that the latter preceded the former. Another aspect of this problem is the part played by the Mixtecs and Zapotecs in Mexican-Maya contacts.

It is clear that we cannot solve this problem without knowing the sequence of cultures in the Mexican and the Maya areas. Written

records are of little help. In Mexico, we have a fairly accurate outline of Aztec history, and some knowledge of conditions in the Valley of Mexico when the Aztecs established themselves in the fourteenth century, and of conditions there and in the Valley of Oaxaca during the following centuries. We have reference in legend and in uncertain historical accounts to the Toltecs. In the Maya area, almost all books were burnt by the Spanish priests, and we can as yet read little of those that remain; a few Christianized Indians translated early records into Spanish; and a few of the Spanish priests recorded the customs and legends of the Maya at the time of and following the Conquest. These provide a confused historical outline for the five hundred years preceding the Conquest. While there are series of dated monuments in Old Empire cities that cover a range of more than six hundred years, the dates are not yet anchored accurately in time, and we cannot read the accompanying text, which may be historical. We have no written records nor oral tradition for the "Archaic" people of the earliest period in either area. The only way to find a satisfactory answer to the problem is by further intensive pottery study in both areas. The work on pottery already done in Mexico by Mexican and American scholars,[57] provides a basis for this study. Charting of the spatial and temporal distribution of varying pottery types has begun, and their correlation, as far possible, with architectural and historical remains. Similar work has started in the Maya area.

Considering the relation of the Mexican-Maya culture area to the rest of pre-Columbian America, an outstanding problem is that of its connections with the high cultures of South America; the extent and the route of influences from one to the other.

The Inca area was superior to Middle America in certain phases of culture, such as metal-working and social organization. We suspect contact between adjacent peripheries of the two areas, chiefly from "Mayoid" objects found in northern South America. Digging in Central America south of the Maya area has until recently revealed little of value or importance, and it has been thought that such contact must have been established by sea. The work being done in Central America at present, however, has uncovered such spectacular remains that we shall undoubtedly find in time a continuous cultural chain linking the

[57] For bibliography, consult G. C. Vaillant, Early Cultures of the Valley of Mexico: Results of the Stratigraphical Project of the American Museum of Natural History in the Valley of Mexico, 1928–1933, Anthropological Papers of the American Museum of Natural History, Vol. 35, Part 3, New York, 1935.

two areas by land. Pottery, Maya pottery in particular because of its geographical position, will be of the utmost importance in tracing such a connection. Pottery, architectural remains, and monolithic monuments are the most important archaeological criteria, since they can usually be considered as having originated where found. In Central America south of the Maya area, most of the early architecture was of wood, and has therefore disappeared; monolithic monuments were rare; pottery, therefore, becomes of increasing importance.

IMPORTANCE AND METHODS OF POTTERY STUDY IN THE MAYA AREA

Architectural remains and potsherds provide the two most stable archaeological criteria in Middle America; their importance is emphasized in the Maya area, most of which is in low-lying tropical country. The climate is so damp, the vegetation so lush, that any perishable material is utterly destroyed. Pottery is less destructible than any other man-made object except artifacts of stone or gold. The latter are rare in the area, metal being considered as unknown during the Old Empire, while pottery is practically universal. It is a more satisfactory criterion than architectural remains. There is only a limited amount of variation possible among stone buildings that conform to a certain cultural pattern; Maya stone buildings, although found at all important sites, were used by a very small proportion of the population. Pottery is capable of greater variation even when conforming to a cultural pattern, and was used presumably by all of the population.

Pottery study is a phase of archaeology that has only recently come to the fore in America. It has always interested the archaeologist, but the interest has often been mainly aesthetic and centered on complete vessels. In fields where there was a great deal of architectural and epigraphical material and abundant literary references, pottery was not needed as a basic historical criterion, and could be considered on its own merits. But as the archaeological method spread, it reached countries where material was often reduced to ground-plans and potsherds. Archaeologists then realized the historical significance of the potsherd, called, by one optimist, the most indestructible object left by man.

Any pottery-making people will presumably continue to develop its own special types by a progressive modification until outside influence suggests a change, or a conquering people enforces one. Changes in technique can occur from the inside through invention but instances of their having done so in pottery making are almost entirely hypothetical.

Therefore pottery sequence can provide chronology for history, to be correlated with literary sources where these exist, to stand alone where they do not. The very lack of pottery can become of tremendous importance, as we see in the southwestern United States.

Pottery is of vital importance in tracing trade and migration. The more we learn from archaeology, the more we realize that intricacy of international relations is nothing new. The ever-present potsherd tells us that the Americans, Africans, Europeans, and Asiatics of one, two or five millenia ago were in a state of flux and confusion as well as their present-day descendants. In all archaeological fields, attention is being focused on these historical phases of pottery study, and the batteries of the exact sciences are being called into play to help extract the last grain of information from the potsherd.

Maya archaeology may be said to have started in 1839 with John Stephens, an American who was the first person to visit systematically and intelligently the ruins in Yucatan and Guatemala. His publications,[58] illustrated with meticulous drawings by Catherwood, introduced the ancient Maya to the world. Serious work in the area did not begin until the end of the century, and until ten years ago, it had not progressed beyond the stage of reconnaissance. Pottery study was at first overshadowed by the same emphasis on spectacular architecture and sculpture that marked the beginnings of archaeology in Greece and Egypt, and was hampered by the impenetrable character of the jungle country in which lie most of the sites that escaped the Spaniards. In the intensive work being undertaken now at various sites by the Carnegie Institution of Washington, the University of Chicago, and the University Museum of Philadelphia, the study of potsherds is coming into its own.

The first work done along these lines was a stylistic study in 1927 of the Maya pottery already accumulated in museums and private collections, by Dr. George Vaillant.[59] Most of it was undocumented; there was, however, enough specific information to enable him to recognize ceramic areas, to see chronological significance in certain types of ware or decoration, and to establish tentative stylistic polychrome sequences in the southeastern part of the area—at Copan, in the Uloa Valley,

[58] Stephens, John L., Incidents of Travel in Central America, Chiapas, and Yucatan, New York, 1841; Incidents of Travel in Yucatan, New York, 1843.

[59] Vaillant, G. C., The Chronological Significance of Maya Ceramics, MS. Thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Harvard University, 1927.

and in Salvador. Such a typological approach is the only treatment possible for material that lacks complete documentation. Its historical value in the Central American field had already been shown by Dr. Lothrop's book on the pottery of Nicaragua and Costa Rica.[60] Vaillant's work could not be as conclusive as this because of the relative scarcity of Maya pottery, and the sporadic distribution of the sites represented.

We can trace the development of a shape or a decorative style in pottery without knowing whether we are following progress or decline. We cannot determine this without knowing the provenience of the pottery, and its position when found. Pottery study today is largely an attempt to work out the most satisfactory way to accumulate and use this information which should tell us the relative ages of pottery types. It is essentially a stratigraphical study, based either on association or soil stratification.

The work done by Dr. Merwin at Holmul, an Old Empire site in the Peten district of Guatemala, and later studied and published by Dr. Vaillant,[61] furnishes an example, in some ways ideal, of the association method. In one mound at Holmul were found five superimposed building periods in the form of sealed burial chambers, and with each period was associated pottery that showed a definite and consistent development from the earliest to the latest period. The situation was ideal since there was no question as to the succession of building periods nor their distinction from each other; the periods were marked by tombs, so that whole vessels were found in each; and there were obvious differences in the pottery that permitted establishing three main and two intermediary pottery periods, although the material was homogeneous enough in character to show that the differences between periods were merely consistent developments of Homul pottery types. The value and authenticity of this sequence have been proven in the work done at the adjacent site of Uaxactun[62] and at Tzimin Kax in British Honduras,[63]

[60] Lothrop, S. K., Pottery of Costa Rica and Nicaragua, Contributions from the Museum of the American Indian, Heye Foundation, 8, New York, 1926.

[61] Merwin, R. E., and Vaillant, G. C., The Ruins of Holmul, Guatemala, Memoirs of the Peabody Museum of American Archaeology and Ethnology, Vol. 3, Part 2, Cambridge, 1932.

[62] Ricketson, O. G., Jr., Excavations at Uaxactun, Scientific Monthly, Vol. 37, July 1933. See also articles by A. L. Smith and E. B. Ricketson in Contributions to American Archaeology, 5 (1932) and 7 (1934), Preprints from Publication 436 of the Carnegie Institution of Washington.

[63] Thompson, J. E., Archaeological Investigations in the Southern Cayo District, British Honduras, Anthropological Series, Field Museum of Natural History, Volume 17, Part 3, Chicago, 1931.

since the pottery from both sites fitted into the Holmul classification. There are, however, imperfections associated with such stratigraphy. The pottery cannot be assumed to illustrate the range for each period since the small number of pieces found with each burial are presumably selected vessels. Moreover, we do not know either the absolute or the relative date of any one period since there are no dates associated with any burial, and we cannot tell how much time may have elapsed between two periods. In an ordinary case of association of pottery and building levels, we should have, as at Piedras Negras, potsherds in and under superimposed floors. This provides a problem which can best be approached by the ratio method, comparing the quantities of distinctive features of shape and decoration present in different levels.

Since dated monuments occur in the Maya area, it would seem that the ideal pottery stratigraphy would lie in its association with a series of such monuments. While Dr. Vaillant used stela association to establish a polychrome sequence at Copan, the pottery found in stelae caches is infrequent and fragmentary. It establishes the fact that a given ware was in use in a given place at a given time; this may be important to the development of that ware at the given site, and it may be of value in a comparative study. The same is true of pottery found in buildings tentatively dated by inscribed lintels. Such pottery was in use before or after a certain date, according to the position in which it is found. Maya dated monuments at present are of little help in pottery sequences.

The stratigraphic percentage study of Pueblo refuse heaps in the southwestern United States, made twenty years ago by Dr. Nelson,[64] provided a chronology for that area, and an inspiration for other archaeologists. Refuse heaps may be fairly easily identified in the flat country of Yucatan, but they are not so easy to find in the hilly southern part of the Maya area. Dr. Lothrop in his publication on Lake Atitlan,[65] in the Highlands of Guatemala, describes a modification of the refuse heap method used by Vaillant[66] in Mexico and Thompson[67] in British Honduras. This consists of trenching through a fertile site to

[64] Nelson, N. C., The Archaeology of the Southwest: a Preliminary Report, Proceedings of the National Academy of Sciences, Washington, 1919.

[65] Lothrop, S. K., Atitlan: An Archaeological Study of Ancient Remains on the Borders of Lake Atitlan, Guatemala, Publication 444 of the Carnegie Institution of Washington, 1933.

[66] Vaillant, G. C., Excavations at Zacatenco, Ticoman, Gualupita, El Arbolillo, Anthropological Papers of the American Museum of Natural History, Vol. 32, Parts 1–2, 1930–31; Vol. 35, Parts 1–2, 1934–35.

[67] *Op. cit.*

bed-rocks, with segregation of material by arbitrary levels if no stratification is evident in the soil. Percentages of wares, rim forms, and significant features are recorded for each level, on the basis of which broad periods of occupation are determined for the site. These are correlated, where possible, with burials or building periods. Such a correlation is a weak point of soil stratigraphy, even in refuse heaps. Few strata are marked by a definite change of shape or ware; the difference is shown by a shift in emphasis, by changing ratios in shapes or wares. Unless one can establish similar ratios in building deposits, or find some unique feature isolated in one level and one building period, the matter of associating the two is difficult. Yet in a site where there are architectural remains, a soil-pottery sequence is of little value if it cannot be correlated with building periods. The use of straight soil stratigraphy at a site where a large refuse heap cannot be located introduces a definite element of chance, since the pottery found has undoubtedly been deposited in a haphazard manner. There is a certain element of doubt as to the contemporaneity of objects found side by side in a refuse heap; there is far more doubt as to the contemporaneity of deposits found at equal depths from the surface in different sections of a site. It is, however, a pragmatic method to be used only until a better one is discovered. If it gives results for one site that are checked by similar work elsewhere or by other methods, it justifies itself.

There are problems of method not only in digging for pottery, but in studying the material found, which is usually in the form of more or less weather-worn potsherds. The two main criteria for classifying are decoration and shape. It must be decided which is the more important, since one is to be used as the basis for determining groups that will be subdivided by the other.

While there is much to be said for both, one must be guided in a decision by what seems most significant in the material itself. In studying the pottery from Piedras Negras, an Old Empire Maya site on the Usumacinta River, the writer chose decoration as the primary criterion, since most of the material was so fragmentary that one could often determine shape only by rim form, which suggests, but does not define the complete vessel shape. Slip color, the simplest type of decoration, determined the wares which formed the major groups. Distinctions between the various polychrome wares were made on the basis of style or technique. Shape was secondary to this.

One should also consider, in establishing a classification, which criterion is the more stable, less apt to recur as a result of independent

invention, since the ultimate aim of pottery study is comparison. In Middle America, emphasis was on elaboration of decoration rather than of shape. Shapes were simple and limited in range, while painted and incised design, and applied decoration became complicated and very detailed. This decoration is presumably less apt to recur independently than the shapes, and is therefore more significant. This is an argument that can be used both ways; the very fact of the simplicity and limited range of shapes can be considered to show more stability and significance than the diversity and complex design of the decoration. The question is one that is largely academic, since significant features will become apparent no matter how material is arranged, and every report should furnish all necessary information as to shape and decoration of the pottery discussed.

There is a third pottery criterion, paste composition, to be considered as a corollary to decoration and shape. It has three factors that must be determined through physical and chemical analyses: the tempering or binding material of the clay, the composition of any pigments used, and the degree of temperature of firing. The most important of these is tempering material, which may be taken as the basis for pottery classification, as was done by Hargrave in the southwestern United States.[68] This use seems unsatisfactory: in the first place, tempering material cannot be determined accurately without petrological tests, impossible, from the practical point of view, to apply to every sherd collected; second, it is limited by the geological properties of the locale, and cannot positively be correlated with variations in decoration and shape at one site; and third, this factor may remain constant, from geological limitations, from site to site where the pottery is obviously different in all other features. It seems best, then, to consider composition as a phase of the study that cannot be ignored, since without it our knowledge of any groups of pottery is incomplete, but as a phase that must be more widely known before we can determine its ultimate value.

RESULTS OF POTTERY STUDY IN THE MAYA AREA

What has pottery study already told us of Maya history? Published work along this line deals almost entirely with the Old Empire cities, an area for which our archaeological knowledge is almost unbelievably fragmentary, considering the fact that fifty years have elapsed since the

[68] Hargrave, L. L., Guide to 40 Pottery Types from the Hopi Country and San Francisco Mountains, Arizona, Museum of Northern Arizona, Bulletin 1, Flagstaff, 1932.

first reconnaissance work was done there. Architectural and sculptural remains have been studied to some extent. According to them, the Maya Old Empire had two main centers: the Peten, where lie the cities of Uaxactun, Holmul, Nakum, Tikal, Naranjo, and Seibal; and the Middle Usumacinta region, where lie Piedras Negras, Yaxchilan, and Palenque, cities where Maya sculpture reached its highest development. Copan and Quirigua were the southeastern outposts of the great stone-city area. The pottery apparently falls into five distinct ceramic groups: the Middle Usumacinta; the Peten and British Honduras; Copan, Honduras, and Salvador; the Pacific Highland (Lake Atitlan); and the Atlantic Highland (Alta Vera Paz and Quiché). While some of these groups, such as the Highland and southeastern ones, undoubtedly contain pottery contemporary with the Yucatecan period, they all have roots in the Old Empire. Only the Yucatecan pottery, which forms a sixth group, is considered here as exclusively later than the Old Empire.

These ceramic areas, although distinct from each other, are interrelated. We begin to see indications of contacts, of influence from one to the other. A study of shape shows straight-sided and flanged bowls, tripod bowls with nicked flanges, and wide-mouthed jars, prevalent in a zone that at present includes the country from the Alta Vera Paz to the Usumacinta, the Peten, and across into British Honduras, but rare in the Pacific Highland and Copan-Honduras-Salvador region. Trade pieces from Copan are found at Piedras Negras, while other sherds indicate the influence of Copan work on Piedras Negras potters. Finely carved vessels reflect the superb style and technique of the stone carvings, and show trade between the Usumacinta Valley and the Atlantic Highlands. Fine orange ware seems to have been traded up the Usumacinta from Jonuta to the Highlands, and to have been copied at Piedras Negras, perhaps on its way through. Pottery sequences already established support chronologies for Maya history that tend to shorten the gap between the Old Empire and the Yucatecan period.[69]

It seems then that in practice, as well as in theory, pottery in the Maya area is a more finely calibrated as well as a more widely distributed and easily studied archaeological tool than either stone architecture or carved monuments. Even the small amount of work done has established distinctions of historical value that demonstrate its vital importance to the archaeological study of the Maya area.

[69] Cf. Vaillant, G. C., Chronology and Stratigraphy in the Maya Area, Maya Research, Volume 2, Number 2, 1935.

AERIAL PHOTOGRAPHY AND ARCHAEOLOGY

DACHE M. REEVES[70]

AERIAL photographs were employed in archaeological work as early as 1880. The results proved the value of aerial photographs, but the methods of raising a camera aloft were unsatisfactory until the invention of the airplane. Also the quality of cameras and sensitive plates was not very good in the early days. For these reasons, aerial photography was applied to archaeology infrequently until after the World War.

Military operations accelerated the development of airplanes. Cameras were designed especially for air use and the quality of lenses and plates was improved greatly. This resulted in a rapid growth of aerial photography. The applications of aerial photographs were limited almost entirely to military uses, including mapping. The post-war development followed similar lines. Aerial photography was found to be indispensable to military operations and all air forces devoted considerable attention to this specialty.

The value of aerial photographs in topographic mapping was recognized early, and mapping agencies were quick to make use of this new tool. Thousands of square miles were photographed for mapping purposes. The rapid improvement in methods of photographic mapping resulted in the formation of the new science of photogrammetry.

Strangely enough, other applications of aerial photography have made slow progress in spite of the many obvious advantages. This is due in part to the expense, but the principal reason is the lack of familiarity with aerial photographs on the part of archaeologists, geologists, and other scientists. To utilize the advantages of aerial photographs fully it is necessary to possess a certain amount of technical knowledge. The cost then becomes secondary.

Comparatively few areas have been photographed especially for archaeological purposes. In at least one case the result was a failure due to ignorance of the technique of interpreting photographs. Most studies have been made on photographs originally taken for military purposes. During the war it was noticed that many of the aerial photographs taken in Mesopotamia by the Royal Air Force showed distinct traces of sites

[70] Major, U. S. Army, Luke Field, T. H.

of former cities. These were often clear enough to permit the ruins to be mapped. About this same time the Germans took a number of archaeological photographs in Sinai.

In 1919, Mr. O. G. S. Crawford made unsuccessful attempts to have the Royal Air Force photograph some British sites. He persevered in his efforts, and finally procured a number of photographs. His interpretation of these, especially the discovery of the missing portion of Stonehenge avenue, aroused considerable popular interest. The indications on the photographs were confirmed by excavations on the ground. As a result of Mr. Crawford's splendid achievements, arrangements were made to transfer all aerial photographs containing archaeological information to the Ordnance Survey Office, and Mr. Crawford was appointed Archaeology Officer to this institution.

Since 1920 there has been a steady increase in interest in aerial photography. It has been employed in Egypt, Palestine, Mesopotamia, South America, Central America, and the United States, though usually on a limited scale. One of the most important surveys was accomplished by the Shippee-Johnson Expedition in Peru.[71] In the United States, one of the first air views of prehistoric earthworks was taken of the Cahokia Mound in October 1921, by Lieutenants A. C. McKinley and H. R. Wells.[72] In 1930, nearly 700 photographs were taken of an area in the Gila River Valley for use in the study of prehistoric canals. These photographs were made for the Smithsonian Institution, the photography being done by Lieutenant Bobzien and Sergeant Stockwell.[73]

Beginning in 1933, the writer has taken aerial photographs of a large number of archaeological sites, principally in Ohio, which are now being studied. No large projects have been undertaken in this country, other than those mentioned, though many individuals and organizations have employed aerial photography to a limited extent.

The art of interpreting aerial photographs owes a great deal to the war. While many features on photographs are distinct enough to be recognized, minor details appear very small on pictures taken from a considerable height. To add to the difficulty, extreme efforts were made during the war to camouflage or conceal ground installations and activities. This challenge was met by developing a special technique for the examination of aerial photographs, including the use of the magnifying

[71] Geographic Review, Vol. 22, No. 1, January, 1932; Johnson, G. R. and Platt, R. R., Peru from the Air, Am. Geo. Soc. Spec. Pub. No. 12, New York, 1930.

[72] Explorations and Fieldwork Smithsonian Institution, 1921, Figs. 101–104.

[73] Explorations and Fieldwork Smithsonian Institution, 1930, pp. 157–166.

glass and the stereoscope. As a result, the accuracy with which an experienced interpreter could identify minute detail was almost unbelievable to the uninitiated.

An adaptation of this same technique has proven valuable in the study of air views of archaeological sites. Where the military interpreter faced the difficulty of identifying objects which had been deliberately concealed, the archaeologist finds that may sites have been almost obliterated by cultivation so that great care is required in the recognition of features. Unless photographs are examined skilfully, it is easy to err in mistaking a natural terrace for an artificial work, or in failing to locate all parts of a prehistoric work.

In the case of the military interpreter, his deductions are verified constantly by the actual examination of captured trenches and other works. Similarly, the archaeologist must be cautious in relying on photographic evidence alone and must check his interpretation on the ground. If a site is effaced, it may be necessary to dig test trenches in order to obtain confirmation of data. It is therefore advisable to take aerial photographs before field work is begun on a site if circumstances will permit.

The most useful type of photograph is the "vertical," so-called because it is taken with the camera in a vertical position with the lens axis perpendicular to the ground. This type may be considered as a form of map with all detail shown in correct relative size and shape at a reduced scale. However, a map is merely a representation of the ground, while a photograph is an exact image. It is this property of showing all detail, however minor, that is the distinguishing characteristic of air views.

An important use of aerial photography is in the discovery of hitherto unknown archaeological sites. This is possible because a photograph will show remains that cannot be seen on the ground. For example, earthworks which have been cultivated for a long period may be so effaced that their existence is unsuspected. Yet from the air distinct traces can be recognized, often in complete detail. This is due to the fact that the earth on the site of a ditch or embankment usually differs slightly in color from the surrounding area. Also, vegetation is affected by the character of the soil. It will usually be more abundant on the site of a ditch, as the ground at that spot has tended to collect water and become softer. Conversely, the site of an embankment is more compact and less suitable for plant life. Slight differences in ground color and plant growth may be imperceptible on the ground, but on a photograph the pattern is revealed. Plate 3, Figure 1, shows an example of an earthwork, now destroyed, which is clearly visible on an air view.

FIG. 1.—Example of a circular earthwork which is effaced on the ground, but shows on an aerial photograph.

FIG. 2.—The circle and octagon of the Newark Works, restored to the original condition.

FIG. 1.—Portion of an aerial photograph of High Bank Works. These works are practically obliterated on the ground.

FIG. 2.—Balloon used for aerial photography. Photograph used by courtesy of the Oriental Institute of the University of Chicago.

Mr. O. G. S. Crawford gives another example.[74] Some of the first discoveries of this kind were made by Colonel Beazeley in Mesopotamia during the war.[75] The writer discovered on a photograph a previously unknown extension to the Newark Works in Ohio on an area which had been graded for use as an airport. All discoveries of this sort should be verified by field work. In digging test trenches it has been found necessary at times to remove one or two feet of top-soil before unmistakable evidence of former earthworks is reached.

A large class of archaeological sites comprise former buildings which have been destroyed or crumbled away until only a low mound is left, as in the case of some Pueblo sites, and many of the sites in the Far East. The difficulty confronting the archaeologist is to know where to dig, as the appearance of such ruins is often similar to the surrounding area. On an air view the various markings combine to form a plan which identifies the site. A fly walking on a rug would have difficulty in recognizing the design, but upon flying above the rug, the pattern would become distinct. In areas known to contain antiquities, time would be saved and the accuracy of field work would be increased by making a preliminary air survey.

It is not often that entirely new sites are discovered. The principal use of aerial photographs is to complete the data on known sites. If excavation is carried beyond necessary limits, time and money are wasted; if not carried far enough, important parts of a site may be missed entirely. In this connection, the air view is a guide to field work.

A second important use of aerial photography is in mapping archaeological remains, particularly earthworks, with accuracy. Many sites have never been mapped and the early surveys of many others are incomplete or inaccurate. In the case of features which have suffered from cultivation or other causes (and this includes the majority, as an undamaged site is a rarity), photography is the only means of securing an accurate plan. Plate 4, Figure 1, shows a view of High Bank Works. These are entirely obliterated on the ground but may be observed in the photograph.

Even when an earthwork is undisturbed, the drawing of a plan may be a tedious task, especially to an archaeologist who lacks training in surveying. On the other hand, the photograph permits a tracing to be

[74] Crawford, O. G. S., Air Survey and Archaeology, Ordnance Survey Professional Papers, New Series, No. 7, Plate XIII, London, 1928.

[75] Beazeley, Lieut. Col. G. A., Air Photography in Archaeology, Geogr. Journal, Vol. LIII, May, 1919, pp. 330–5; Vol. LV, Feb., 1920, pp. 109–27.

made in a short time. Plate 3, Figure 2, shows the circle and octagon of the Newark Works which have been restored to their original condition. It will be seen that the photograph itself is a map, and details may be traced from it. For convenience in use a photograph may be enlarged. A pictorial view of the same spot is given in Plate 5 for comparison with the vertical picture. The oblique or perspective view is not as suitable for mapping, due to distortion, but it is useful as showing relative elevations. It is also easier for the layman to understand and therefore has excellent pictorial value.

Where large sites are being excavated, it is desirable to take a series of pictures at intervals to show the progress of the work. Each successive stratum may be recorded quickly by means of the aerial camera. Unfortunately, this method is seldom feasible due to the expense of employing an airplane regularly.

As a substitute for the airplane both balloons and kites have been used. The first archaeological aerial photographs were taken from a free balloon, and later small balloons, just large enough to raise a camera, were employed. This pioneer work was performed by Major Elsdale of the British Army in 1880–1887. Kites have also been tried at various times. Shortly before the war, Mr. Henry S. Wellcome used kites successfully in photographing his archaeological explorations in the Sudan. For a more complete historical account, *Wessex from the Air*, by Crawford and Keiller,[76] should be consulted. The above information is taken from their publication. In recent years The Oriental Institute of the University of Chicago has been using a meteorological balloon for aerial photography of sites. Plate 4, Figure 2, shows the balloon used, and Plate 6, Figure 1, is a vertical view of a part of Megiddo, and illustrates one type of site which is difficult to survey on the ground. A large amount of measurement is required to produce an exact plan. The advantages of air views here are obvious.

The main obstacle in the way of a wider use of aerial photography is not the lack of means to raise the camera, but the camera itself. In order to get clear sharp pictures, an excellent lens and panchromatic plates or films are required. Ground cameras are not satisfactory for air use, and aerial cameras are heavy and expensive. No doubt if sufficient demand developed, manufacturers would provide a high-grade small aerial camera suitable for use with kites or balloons. At present it is necessary to use a ground camera and make adaptations for aerial use. These remarks do not apply to large projects for which airplanes with standard aerial cameras are suitable.

[76] Crawford, O. G. S. and Keiller, Wessex from the Air, London.

Oblique view of the Newark circle and octagon.

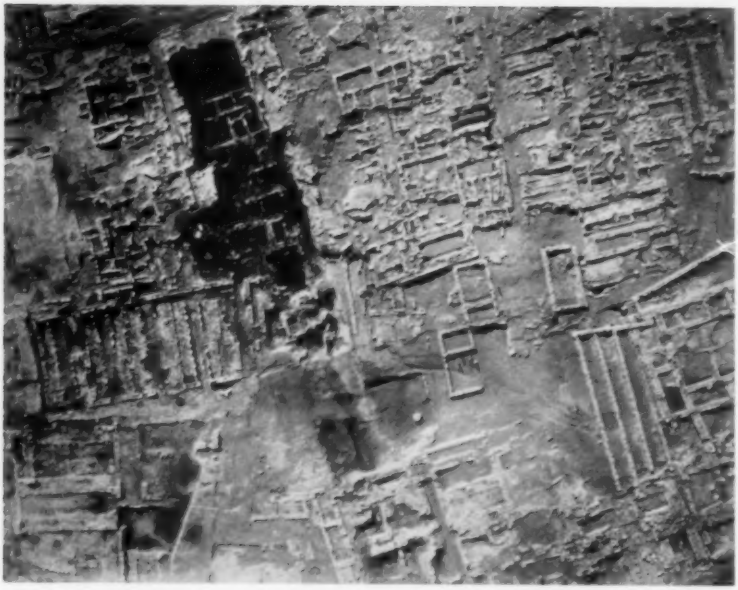

FIG. 1.—Aerial view of Megiddo, showing the Stables of Solomon. Photograph used by courtesy of the Oriental Institute of the University of Chicago.

FIG. 2.—Vertical photograph of the Great Serpent Mound, from 10,000 feet.

FIG. 1.—Example of a defensive work. Vertical view of Fort Hill.

FIG. 2.—Oblique aerial photograph of Miamisburg Mound.

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A knowledge of the topography surrounding a prehistoric site is valuable in endeavoring to determine the reasons which influenced the selection of that particular location. Such features as water supply, timber, trails, nearness to navigable streams, and defensive value help to establish the food supply, living customs, and other cultural traits of the builders. Unfortunately, archaeological literature seldom affords complete topographic information. This is a natural result of the lack of detailed maps. For some areas large-scale maps were not obtainable and the cost of special surveys was often prohibitive. Many otherwise excellent reports of excavations fail to give sufficient data onto pography.

Aerial photography furnishes a rapid, inexpensive and accurate source of topographic information. Vertical photographs are taken at such a scale as to include the desired area. If the area is too large for a single picture, a series of overlapping photographs are taken. Plate 6, Figure 2, is a view of the Great Serpent Mound from 10,000 feet, taken especially to include the surrounding area. For study of the Great Serpent Mount itself, pictures were taken at a larger scale. This view shows the narrow, sharp ridge overlooking Brush Creek, and the low valley beyond. This sharp ridge ending in a point of rock is very appropriate as a resting place for the Great Serpent.

Plate 7, Figure 1, illustrates a defensive earthwork. This is in heavily wooded country and it was necessary to take the photograph in the winter when the embankments were visible through the trees. The fine parallel lines all over the picture are the shadows of the bare trees. As shown by the photograph, Fort Hill occupies a flat-topped ridge with steep slopes on all sides.

The oblique photograph is of excellent pictorial value as it affords a more striking view than can be obtained on the ground. It also shows the local topography. Plate 7, Figure 2, is an oblique view of the Miamisburg Mound, the largest conical mound in the United States. Formerly the Grave Creek Mound held that distinction, but recently the tip of Miamisburg Mound was restored, and this operation raised its height sufficiently to surpass its ancient rival. This plate shows the mound located on a plateau with the Miami River in the distance. The great height of the mound is apparent by comparison with other objects.

Aerial photography is still a young science, but its contributions to the older sciences have been outstanding. In the field of archaeology it furnishes a new instrument of research and exploration. As its methods and technique are improved, aerial photography will increase in scientific value. In the not distant future, it will become an indispensable adjunct to field work.

PROSPECTS IN CALIFORNIA PREHISTORY

A. L. KROEBER[77]

ARCHAEOLOGY in the California area has been notoriously slow to recover cultural sequences. In part this is due to most of the earlier explorations having been conducted without sense of genuine scientific problem, as in the first stages of work in so many other regions. But in even larger measure the delay in discovering positive time changes is the result of difficulties inherent in the archaeological data of the area. Mostly there is no pottery at all. The historic cultures being simple, their artifact inventory is fairly limited and lacking in specialized types. Except in the Santa Barbara region, the numerical yield of specimen data is low for volume of soil moved. The San Francisco Bay mounds, for instance, tend to furnish only about one artifact, whole or broken, per cubic yard dug. This is probably not far from the average productivity the state over, the Santa Barbara coast and islands alone omitted. Excavation is therefore time-consuming and costly before data sufficient for conclusions can be accumulated. All in all, the consequence is that the available knowledge, in spite of the participation of trained men like Uhle, Nelson, and Schenck in its gathering, has remained chronologically flat. We have only occasionally been able to distinguish the historic from the prehistoric; what was earlier and later in the prehistoric has remained wholly undifferentiated. As late as 1925, in the *Handbook of California Indians*, I felt forced to say not only that cultural change in native California was relatively slow and slight—which is presumably true enough—but that with a few exceptions, too sporadic to piece into a systematic interpretation, we had no knowledge of what the changes were. The chapter on "Prehistory" in that volume is essentially a negative one, as regards development.

The last ten years, however, have brought several glimmerings, which I will try to unite into a ray, however faint.

In 1929, David B. Rogers published his report of explorations on the Santa Barbara Coast. In this he distinguishes three successive cultures: Oak Grove People, Hunting People, and Canaliño (historic Chumash). The first had metates but no mortars; the last, mortars but no metates. Many other distinctions are cited, but this metate-mortar change hav-

[77] Dept. of Anthropology, University of California, Berkeley, California.

ing been independently confirmed, can be accepted as a guide. Rogers' book contains a mass of valuable data, especially topographic, but the real evidence on which his period-differentiations are based is nowhere given specifically. His middle or Hunting period remains unconfirmed.

Olson worked in the same region in 1927 and 1928. His full results have not been published, but a preliminary report in 1930 confirmed Rogers' priority of a metate over a mortar culture. This result is unquestionable, being stratigraphic from two key sites at Rincon. Starting from these, Olson was able to place other sites containing a richer inventory. He distinguishes, in fact, three pre-Caucasian periods on the mainland, but his Intermediate one being transitional between Early and Late, except in bone pendant development, can be omitted for present purposes. In any event, Olson's Intermediate does not seem to tally with Rogers' middle or Hunting period. On the islands, Olson distinguishes an earlier and a later period; but he places the earlier as about contemporary with the mainland intermediate, or even somewhat later. Either the prehistoric occupation of the islands was shorter, or the evidences of its beginnings have not yet been found. The island-mainland correlation is an interesting problem, but essentially a local one, and can be passed over here.

Arranging the Olson mainland data in terms, accordingly, of merely Early and Late, we find these distinctions:

Early only: metates and mullers; plummet-shaped charmstones.

Rare in Early, more abundant in Late: use of asphalt; of steatite; mortars and pestles.

Late only: circular shell fishhooks; steatite vessels; pseudo-metates.

Perforated stones can perhaps be added to "Late only," but owing to the accident of Olson happening to find them only on the islands, the point will not be pressed now. Olson's finds are considerably less extensive than Rogers', but they are used because his interpretations flow from specific, cited data, whereas the interpretations of Rogers cannot be checked, their finished scheme having been used as a framework in which to present his particular data.

If now we turn from southern to central and northern California, most of the Santa Barbara Early-Late criteria fail us. There are no more shell fishhooks, generally no steatite vessels, little asphalt, often no metates; also no stone mortars on the floor of the Great Interior Valley. The plummet-shaped charmstone, however, continues through this valley and on the coast abreast of it. We shall try to use this as a guide.

In the same year as Olson, Schenck and Dawson published on the northern San Joaquin valley, specifically on the Stockton-Lodi area, for which the Barr and Dawson collections were available. These had been assembled without clear sense of developmental problem, but were accompanied by site and depth data. Schenck is very hesitant in expressing himself as to time changes, but finally makes a tentative classification of his pre-contact sites, and their inventory, into an earlier and a later period. The earlier possesses plummet-shaped charmstones; the later, "very few." This is probably the actual situation on the Santa Barbara coast, too, Olson not happening to find any of the relatively few charmstones that continued to be used. So far as we have data from the surviving California Indians, they all (except in the extreme north, south, and east of the state) knew charmstones but did not make them. The stones were found; kept and used by men with supernatural power; not touched by other people; and often believed to be animate and self-moving.

Here then we have an apparent time correspondence between two local cultures 300 miles apart. Let us review the remainder of Schenck's suggestions as to time. Positive Early criteria are few: mica ornaments and crystals, the latter continuing occasionally into Late. Negative criteria are more numerous: pipes, delicate arrowpoints, "Stockton curves" of chipped obsidians, incised bird-bone tubes, disk beads of clamshell, steatite or other stone beads. Rare in Early sites are baked clay balls (cooking-stone substitutes) and haliotis ornaments. These absent and rare types are precisely the ones which constitute the distinctive inventory of the tentatively reconstructed Later prehistoric culture of the Stockton-Lodi area.

Adjoining Stockton-Lodi on the north is the lower Sacramento valley, where Sacramento Junior College has for several years been actively exploring mounds under the leadership of President Lillard. Only one report has so far appeared, on the Deer Creek-Cosumnes valley, 1936. This is an over-brief condensation, and fails to make clear the evidence on which it classifies finds into Early, Intermediate, and Recent. This deficiency will presumably be remedied in further publications on other districts in which, according to foot-note allusions, systematic excavations have already been conducted. The Intermediate and Recent cultures are alike, except that the latter adds European objects. We can therefore segregate as before simply into "Earlier" and "Later." The results are on the whole parallel to the estimates for Stockton-Lodi.

Early Stockton	*Early Sacramento*
Present:	
Spearpoints	Large leaf-shaped blades
Charmstones plentiful, rare in Late	Charmstones, rare in Late
Round and square ornaments of haliotis	Round and square ornaments of haliotis
Quartz crystals, rare in Late	Crystals
	(Pipes reported, but not found)
Absent, but found in Late	
Arrowpoints	Delicate arrowpoints
Haliotis ornaments with projections	
Pipes	(Pipes)
Baked clay balls, etc.	Baked clay balls (few in Early)
Disk beads of clamshell	Disk beads of clamshell
Incised bird bones	Incised bird bones
Steatite and other stone beads	Steatite and other stone beads
	Curved obsidian blades

It is clear that two sets of workers have come to almost identical conclusions for the adjacent areas. It may be added that in the Stockton district burials were overwhelmingly extended; in the Sacramento district, either extended or flexed in the Early period, and flexed in the Late. California in general flexes.

The San Joaquin and Sacramento reach salt water in San Francisco Bay; and here first Uhle and then Nelson worked intensively long ago. Uhle indeed announced a sequence; but his data were few, precisely because he worked with care, and scarcely support his conclusion. Nelson left California before he had come to conclusions as to time changes. Both these early investigators were also under pressure from geologists to ascertain the maximum age of the human remains, and were therefore concerned with such problems as that of subsidence below sea-level; and in Uhle's case, of palaeolithic affiliations. Recent work tends to center around the problem of cultural change, and, by starting with native remains with which post-contact artifacts are associated, works back first to a pre-contact Late culture, and then, if possible, to a differentiated one which is presumably Early, or at least Earlier.

In 1924, the Emeryville mound, in which Uhle had sunk trenches and a tunnel twenty-two years earlier, had its upper remaining twenty-two feet, that is, all but its base, removed with a steam-shovel. Schenck followed this wholesale industrial excavation, subsequently carried trenches into the untouched lower eight feet, and in 1926 published a

careful report. Conditions were not of the best for culture change determinations, and Schenck evidently was considerably preoccupied with showing that previous estimates of absolute age of the mound were unprovable and probably excessive. Nevertheless a few points emerge which may bear on our argument.

From the trenches in the base of the mound, four charmstones were secured; all of them perforated, and three of steatite.[78] From the cone above, thirty-six were recovered; thirty-four were not perforated, and thirty-two not of steatite. The four (or three) hand-dug bottom pieces were found in about 250 cubic yards of mound material; the thirty-six upper ones, in 26,500 cubic yards. Schenck estimates that addition of unrecovered specimens seen would bring the number noted up from thirty-six to about fifty. This gives a ratio, for equal volumes, of 300–400 for the bottom, of 50 (or somewhat more on allowance for undetected pieces) for the middle and upper parts of the mound. The series are too small for certainty, but at least suggest a change of type and diminution of frequency with the progress of time. Complete disappearance of charmstones is not to be expected, because wherever they occur archaeologically it has been found that the historic Indians used some prehistoric specimens.[79]

It begins to look as if the large Bay shellmounds, in which the first scientific excavations in California were undertaken, were perhaps the least favorable for attacking time-change problems, on account of their combination of very size with meagerness of content.[80] At any rate,

[78] The fourth, of sandstone, was near the trench surface, in soil which may have been disturbed by the steam-shovel.

[79] Schenck found no pipes below the upper seventeen feet, but an attempt to connect this absence with the apparent absence of pipes from the Early mounds or levels at Sacramento and Stockton would be illusory, because he recovered only five specimens in these upper seventeen feet, so that, if pipes had been in use with equal frequency throughout the history of Emeryville, the expectability of finding even only one specimen in the 1/100 volume of the basal trenches should be only one chance in twenty.—For analogous reasons my Handbook table, based on an unpublished compilation by Nelson, cannot be used with reliability for any specific problem.

[80] The characteristic "Late" inventory of the Stockton-Sacramento area is presented only partially and sporadically by the mounds on San Francisco Bay. There are no finely incised bird bones, haliotis ornaments with tabs, ornamented clay balls, curved obsidians, steatite vases; and, equally important, no corresponding distinctive luxury types peculiar to the Bay. The perforated magnesite cylinders, of a material which emanates from one deposit in Pomo territory near the mouth of Clear Lake, have been found at Stockton-Lodi, but not on the nearer Bay. The latter was evidently a culturally stagnant area in later prehistoric times, in spite of the size of its shellmounds.

the question of absolute age with which Uhle, Nelson, Gifford, and Schenck wrestled, will have to be abandoned until some definite progress has been made on the problem of what developmental changes occurred in the area. Schenck has shown conclusively that the age estimates of his predecessors are without real reliability, and that the accumulation durations of the deposits may have been much shorter than they calculated. But he has not been able to show that they were shorter; and his final results therefore are critical but negative. Equal effort, no less critical, but directed at positive findings of developmental change in relative time, might or might not have been more productive. Possibly the most fruitful attack hereafter will be on a series of small mounds in one district, each representing presumably a rather short period of accumulation; and through comparison of their total artifact inventories per equal volume. In this way relatively pure culture levels might be isolated, whose succession could then be investigated. After all, Olson's key excavation at Rincon was of this order: two adjacent mounds whose horizons abutted or overlapped, rather than an ideally complete stratigraphy in one vertical section.

Halfway between Sacramento-Stockton and Santa Barbara, in the southern end of the Great Interior Valley, Schenck and Gifford, during 1923–24, surveyed and excavated on a small scale. The problem of successions could scarcely be reached. Steatite seemed relatively recent, and an occasional mound, like Site 11, seemed older than the majority. For much of the area only pre-collected material was available; largely so for charmstones, unfortunately. In 1933–34, a Smithsonian party under Strong and Walker excavated systematically, on a high man-power basis with relief workers, at Buena Vista lake. An earlier and a later culture are understood to have been definitely distinguished, but no report is yet available. Whatever the results as to cultural successions, they will almost certainly have bearings on the conclusions tentatively set up for the areas to the north and south. Schenck's survey, and in fact Nelson's recovery in 1909 of part of an accidentally discovered find, have shown certain southern relations for this upper end of the San Joaquin valley which had been unsuspected from the known ethnography; but it has been impossible to gauge whether these relations were relatively early or late. Here the Strong-Walker report may well be decisive also.

The far north of the state is the least explored. In general, it is the coasts and larger valleys which contain the most inviting prehistoric sites in California, and there the Indians are mostly long since extinct

or absorbed. Recent ethnology is preserved in hill and plateau districts, where ancient sites are scattered and small. Our fullest ethnographic data are therefore from well north of San Francisco Bay-Sacramento, but the prehistoric data from the same area are almost nil. It is as the sole exception to this discouraging lack of correlation that Loud's excavation of an island site in Humboldt Bay, inhabited into historic times by Wiyot, is important. It yielded no successive cultures, but at least a culture which differed somewhat from the historic one. This culture included typical and specialized recent Northwest California artifacts, such as the curved adz handle, shaped maul, large obsidian and white flint blades, sea lion harpoon, concave stone pipe and stone bowl for insertion into a wooden pipe, all of which were in use as late as 1900 among the neighboring tribes. But the Gunther Island site also yielded animal-shaped clubs of stone ("slave-killers"), a few clay balls, a clay pipe, and cremations, which did not exist in the historic Wiyot-Yurok-Hupa culture since at least 1800. There is accordingly reason to hope that with archaeological skill and fortune sites may yet be discovered in this area which will definitely picture an ancient, formative stage of its recent native culture. Further, since the animal clubs point to the north, and the clay balls and cremation to the south, it may be anticipated that this earlier culture will prove placeable in a larger geographic as well as chronological frame. Charmstones unfortunately have not been found in the Northwest either historically or prehistorically.

Our one thin guiding thread backward into the prehistory of most of California is, then, to date, the much-debated plummet-shaped stone which the historic Indians did not make but did use as a charm. On the story of its relative frequency, or perhaps changes in form, there can be strung other facts of more local distribution, such as the development of circular fishhooks and the metate-mortar displacement on the Santa Barbara coast, the appearance of pipes, clay balls, bone incising, and delicate chipping in the heart of the Great Valley; with which in turn other distinctive phenomena may be expected to correlate. The problem at this stage does not seriously concern the purpose or function of the charmstone, but the empirical facts of its essential typology and horizontal and vertical distribution. Other artifacts may ultimately prove to be even more useful; but it does seem as if the charmstone, treated by the strict Nordenskiöld method, or analogously to the potsherd in pottery areas, will definitely help us to arrive at interpretations on cultural sequences.

At the same time it is indispensable to realize how scant and sketchy

all our associations and tie-ups, and therefore inferences, still are from the point of view of real evidence. Olson's data prove something, but are too limited to prove much. They include no charmstones from Late sites when we are almost certain charmstones were still used, and are therefore defective for a complete picture. Rogers' conclusions are likely to be true to a considerable degree, on account of his large experience and material, but cannot be used as evidence because his data have been passed through the subjective crucible of one mind. Schenck has no positive findings for San Francisco Bay or the south end of the Great Interior Valley, only hesitant suggestions for Stockton; Lillard, whose conclusions for adjacent Sacramento are very nearly the same, appears to have derived them from valid evidence but has not yet set this forth so that it can be controlled. In short, we have clues, and should feel encouraged; but we have not as yet any proofs for generalizations of breadth or depth.

California prehistory has long been resistive to interpretation, and promises to remain so. Many factors contribute to this condition: absence of pottery and of permanent structures; a limited culture inventory; quantitative meagerness of remains in most sites; paucity of ethnographic data where archaeological ones are most accessible, and vice versa; unusual sessility, from all indications, of population; and conservative stability, in the large, of culture. The nut will be hard to crack; this must be frankly admitted in advance. What the situation above all calls for is described by a phrase which I learned from Boas, as he from Virchow: "icy enthusiasm." The ice of criticism is indispensable; Schenck has well shown its need. But, given this, enthusiasm for real solution of soluble problems is equally necessary. A defeatist attitude will accomplish nothing. What I have tried to show in the foregoing pages is that there is no reason for defeatism. What has been done in Europe, in the Southwest, and elsewhere, can be done here, if the approach is correct. After all, the prehistory of the eastern United States has been dealt with for a hundred years, or twice as long as that of California, and we do not yet understand it. But who doubts that sound understanding will ultimately issue from sound conception of problems, sound method, and enough work? In both areas we may be on the very brink of organization of the foundations of permanent interpretation.

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A SHELL BRACELET MANUFACTORY

ARTHUR WOODWARD[81]

SOME OF THE most common artifacts found on all of the ancient Hohokam sites in southern Arizona, and upon many of the Pueblo sites further to the north in both Arizona and New Mexico, are the thin, well-made bracelets, earrings and finger rings, fashioned from the Glycimeris shell. The broken fragments of these specimens are particularly noticeable in the great trash heaps marking the Hohokam villages. The normal type is a plain, smoothly-cut, well-polished circlet of shell, usually perforated with a small hole at the apex of the hinge.

Although archaeologists have long been familiar with these, and know that the shells from which they were made are found in the Gulf of California, the origin of the artifacts themselves has not been established. It has been inferred that the Indians of the interior obtained the complete shells in trade, or that in ancient times the inhabitants of the Gila and Salt valleys traveled to the Gulf, a nine days' journey on foot, even as the Pima and Papago have resorted thither for salt in more recent historic times.

In 1931, Drs. Carl Sauer and Donald Brand made a brief report upon a site known as Boquillas, in northern Sonora,[82] describing some shell blanks and a few stone artifacts from that place. The article is ably written from an archaeo-geographical point of view, both of the authors being primarily, geographers. However, they failed to comment upon the site as being a potential manufacturing center of these ornaments, and therefore a possible important center for their distribution along the trade routes to the north.

In describing this site, the following statement is made:

"Somewhat west of north of Las Trincheras, along the Santa Ana-Altar road is the site we have named Boquillas after the stream that flows through it. This is a basin (bajio) site of somewhat more definitive character than the one on the Santa Rosa Ranch (site 17). It is an arid low land of reddish clay which has been ripped repeatedly by sheet washes, so that broad patches within it are bare of vegetation and

[81] Los Angeles Museum, Los Angeles, California.

[82] Sauer, Carl and Brand, Donald, Prehistoric Settlements of Sonora with Special Reference to Cerro de Trincheras, University of Calif. Publications in Geography, Vol. 5, No. 3, pp. 93–94; 113–114.

heighten the general effect of desolation. At first site the place looks like a desert pavement, scores and tons of fist-sized rocks being scattered over the clay plain. Up slope the rock screen cuts off quite sharply. The rocks are broken fragments, more angular and less variable in size than the talus that forms on the local mountain flanks. The site covers at least a hundred acres (site 19). Scattered over it are many little mounds three feet high invariably covered with rock. The clay beneath the mounds is undisturbed, stratified as it was deposited. We concluded therefore that the mounds, mostly elongated in the axis of the valley are the result of sheet flood erosion, that the entire surface since its habitation has been lowered about three feet by sluicing, with the exception of certain small surfaces protected by a riprap of rock. Especially toward, and at the margins of the site, lines of rock, scores of feet long can be traced.

"It is obvious that the stone was carried in, in selected sizes and notable amounts, from a distance of at least several miles and that it was used in some manner for construction. There are indications of square rooms. The site in the bottom of an aggrading basin subjected the inhabitants to inundation during summer rains. The location, one suspects, was tolerated only because of unfailing water. Perhaps the outer rock lines marked stone surfaced embankments by which the shallow muddy floods were turned from the village. The significance of these small rock chunks in house construction is not apparent unless it would be in lining the sides of pit houses. There are far too many stones and the individual heaps are too large to lend weight to the notion of their use in fireplaces.

"The Boquillas Arroyo is ripping out a channel now about twenty feet deep at this site. Toward the end of the dry season, water was flowing in the channel in sufficient amount to support swarms of minnows and water plants. Under our view these clay-bottomed basins normally are aggrading areas, lately exposed to ravine washing through the interference of civilized man. In the days when the ruins were occupied, channel trenching was non-existent, the water flowing off through shallow *charcos* (pools) and *cienegas* (swamps), partly blocked stretches due to the movement of detritus from range flank into basin center. The immediate location of the village may well have been along such a mesquite shaded pool, with extensive temporal fields, situated in the likeliest places of overflow and sufficient to raise the bean crop and perhaps some of the corn of the village.

"As long as they are undissected, such lands in this district are now

used for wheat and bean farming. The flood plain of the Magdalena to the south may also be regarded as having been available for producing food. The site now is forbidding in the extreme, yet there is nothing physically improbable in the reconstruction suggested.

"Several two foot pestles, showing hard use indicate dependence on mesquite or other seeds of the desert as metates testify to the use of grain. Incidentally, with one exception the grinding stones (manos) were biscuit shaped, though the metates were of the ordinary form (pl. 16). Flint spalls and spalls of the peculiar dense green igneous rocks from which the Sonora axes are made are very common. The pottery was abundant in spots and exclusively of the Trincheras ware. Bracelets of Glycimeris shells were found and hundreds of the shell cores that were left in cutting out the bracelet (fig. 3)."

In the summary of archaeological data, further reference is made to the shell specimens: "The Boquillas site is particularly rich in the cut-out centers which can be picked up there by the hundred (fig. 3). They were sawed out with considerable skill, the blanks showing only smoothly cut surfaces, without drill marks. Professor Bruce Clark has examined a variety of shells and determined their provenience from the Gulf of California in every case."

In October, 1935, while engaged in a historic survey of the Kino mission chain as a member of the National Park Service party, I examined a number of the shell cores left in the process of manufacturing the bracelets and earrings at the ranch of Mr. Roy Cutting in the Altar Valley. Mr. Cutting stated that the specimens came from a site well known to him, and offered to guide us to it. Accordingly we visited it on October 28, and made a small type collection. The site, locally known as La Playa, is twenty-eight miles northeast of Altar on the Altar-Santa Ana highway.

The eroded place containing the greatest masses of broken stone and shell fragments is some four or five hundred yards north of the highway. However, as an archaeologist, my interpretation of the village deposit differs from that offered in the foregoing paragraphs.

My reasons for differing are as follows. Although the masses of stone and shell lie upon the hard red clay, they seem to have been redeposited, rather than resting *in situ*. The top soil is soft, probably water-deposited and extends in all directions from this washed out area. Upon this surface are the indications of Indian occupation, and these evidences extend over the surface of the desert, across the Boquillas Arroyo, to the east. Here may be found the scattered shell forms, the pottery, hammer-

stones, and chipped implements, over a wide area, indicating a long period of occupancy.

In ancient times the clay plain may possibly have been occupied. However, the occupation apparently continued and the camp refuse is now distributed through the softer top soil. As the channels cut their way through this, the heavier stones, shells and other debris have been washed out and have settled upon the irregular clay bed beneath. Thus, there is a layer of such material, and the small clay mounds are covered with this debris. It is a concentration by redeposition of material rather than an original placement. This is further confirmed by the fact that flexed burials and other human remains, poorly preserved, some partly exposed in the margins of the area, indicate a partial displacement by removal of the earth. The sides of the cuts are filled with the same type of material found on the hard clay subsoil.

Aside from shell cores, complete shells, and the broken fragments of incomplete ornaments, there are literally dozens of perfect chipped blades, ranging from small lance heads and knives to arrowheads. There are also numerous hammerstones, some of which seem to have been confused with small manos or mullers. These hammerstones are typical of such implements throughout the country. They are found by the hundreds upon every site where primitive artisans have plied their trade of stone-working. Usually these implements were of the hard green diorite from which the three-quarter grooved axes, so familiar to archaeologists of the Salt and Gila valleys and of northern Sonora, are made. Chunks of tough chert were also used.

These hammerstones are small round or oval pebbles, selected for their weight and convenience in fitting the hand, and showing definite signs of abrasion on the ends or sides. Their presence on this site is readily explained by the thousands of large and small spalls of the varicolored chert-like material from which the chipped implements were fashioned, as well as the round, pencil-like drills and the sharp-edged flakes which may have been some of the implements utilized in cutting out the centers of the shells in the manufacture of the bracelets. Incidentally, the hammerstone may have been used in separating the core from the body of the shell.

The method of manufacture was simple, following the same methods employed by some tribesmen in the fabrication of other shell and stone artifacts. The upper surface of the shell was marked off by deep, regular, short scratches, in which the workman sawed away with his flakes, keeping an even, straight groove.

Plate 8, Figure 1, shows a series of these shell cores and parts of the finished ornaments. It will be noted that the edges of the cuts are regular and smooth. However, the edges of the under side of the same shells are rough. Apparently, when the workman had deepened all of the grooves, he simply tapped the center with his hammerstone and it fell out, splintering the underside in the process.

Similar techniques of stone sawing and breaking were used by the natives of Alaska and British Columbia in manufacturing jade implements. The cuts were made with sharp sandstone tools; then wedges were inserted, and the thin sections broken off.[83]

In southern California, the Canaliño employed the same method in reducing steatite fragments to the desired size. A number of pieces indicating this treatment were found by the Van Bergen-Los Angeles Museum field party at the village site of Muwu in 1929.

The principle of making short, straight cuts in stone or shell was practised by the lapidaries further south in Mexico when fashioning the pale green jadeite amulets, small plaques, and masks. The eyes, mouth, and nose are usually made with short, straight, abraded incisions, and later rounded by skillful polishing.

After the center had been removed, the ragged edges of the crude bracelet were ground down, and the bracelet was smoothed with finer-grained stones. Constant use of shell ornaments produces a glossy patina that even the centuries cannot efface.

There was yet another method of manufacturing these bracelets which was not in evidence on this site as far as I observed, but which was practised by the Hohokam. This consisted of rubbing the umbo of the shell upon a slab of smooth-grained sand stone or shale until a hole was worn through the hard shell. Then, probably, the center was carefully reamed out with roughly chipped tools or flakes, or perhaps with larger chunks of sandstone or shale. The resulting ornament was similar to that produced by the former method. A very good example of such technique may be seen in the shell artifacts preserved in the Casa Grande National Monument Museum, Coolidge, Arizona.

There may have been an excellent reason for not using a large drill on the shell. These shells are extremely hard, and to produce any sort of a hole in them, one must press heavily and drill fast. The combination of pressure and heat generated by the drill is likely to shatter the shell.

[83] Emmons, George T., Jade in British Columbia and Alaska and its use by the Natives, Indian Notes and Monographs, No. 35, Museum of the American Indian, Heye Foundation, N. Y. 1923.

American wampum makers in the early 19th century, working with the heavy Bahama conchs and the hard clams from Long Island, New York, discovered this, and did much of their drilling of the long, shell hair pipes, and shell "moons", so beloved by the Plains people, under water, or used water copiously in the course of their manufacture.[84]

Among the Hohokam of the Gila valley, the technique of shell carving was advanced to a high degree. In the Colonial period, the Hohokam artisans produced some of the finest examples of this art found in the Southwest. The designs range from simple incised patterns of transverse lines to elaborate ones of reptiles, birds and human figures.

A number of fine examples of this work were uncovered in the cremation burials on the Grewe Site by the Van Bergen-Los Angeles field party, two miles east of the Casa Grande National Monument, in the spring of 1930. Here we found a mass of fragmentary, calcined, carved shell bracelets, dropped into a shallow burial trench in the caliche as offerings to the deceased. These fragments were under the shattered remains of a rectangular, box-like pottery vessel, decorated with a red-on-buff pattern. The burned fragments of the heavy, carved bracelets had apparently been taken from the crematory pit, placed in this pottery container, which was then dashed into the trench, shattering the vessel, and strewing its contents on the bottom of the trench.

The motifs on these fragments were varied. One consisted of a human figure, arms upraised in cameo relief, and long reptilian creatures with long jaws set with teeth, representing caymans or lizards. The "horned toad" was another design, but the favorite seemed to be two birds seated back to back, forming the bezel of the bracelet. These birds held the heads of rattlesnakes in their beaks, and clutched the rattles of the serpents in their claws. The twined bodies of the snakes formed the body of the ring.

In the loose earth near another burial were found two small finger rings (Plate 9), carved with the same motif. These rings are shown enlarged to bring out the details of the carving. Actually they are scarcely three-quarters of an inch in diameter.

Examples of Hohokam shell carving were also found in the Mimbres valley, on the Cameron Creek site, by the late Wesley Bradfield.[85] Two large bracelets, carved with this same twined-snake motif,

[84] Westervelt, Frances A., The Final Century of the Wampum Industry in Bergen County, New Jersey, Papers and Proceedings, Bergen County Historical Society, No. 12, 1916–1917, pp. 20–38.

[85] Bradfield, Wesley, Cameron Creek Village. Pl. CII. Santa Fe, 1931.

FIG. 1.—A series indicating the process of manufacture of the shell bracelets. At the left is a large core; immediately above it is a broken segment of an unfinished ornament and two thin sections of broken bracelets. On the right are eight cores illustrating methods of cutting and breaking. The center row shows the reverse side with the ragged, broken edges.

FIG. 2.—The larger points were found at La Playa. The longest is 2¼ in. long. The small points are from the ruined quarters of the neophytes of Mission Santa Teresa.

Two carved Glycimeris shell finger rings enlarged two and one half diameters. These were uncovered on the Grewe Site, Gila Valley, 1930. Now in the Los Angeles Museum.

found in pit house ruins at that site, appear in his paper. However, Mr. Bradfield did not suggest their provenience.

Dr. Ralph Beals, of the Department of Anthropology, University of California, Los Angeles (Southern Branch), has a carved shell bracelet similar in all respects to those bearing the frog motif from the Gila valley, which he found on a site in Sinaloa, Mexico.

The query may then be raised: were some of the elaborately carved bracelets found in the Gila valley and elsewhere actually made there, or were they imported from places similar to the site found in Sonora? Or did the Sonora tribesmen simply furnish the blank armlets, which were given the finishing touches by the Gila craftsmen?

In general, the artifacts of the Colonial Hohokam period reflect in a modified way the elaborate workmanship of the artisans of south-central Mexico, from the states of Guerrero and Oaxaca. Rattlesnakes, birds and human figures were the favored subjects for carving in shell, stone and bone.

There are other Mexican traits displayed in the artifacts from the Gila valley sites: legged vessels, circular mirrors with backs of fine-grained sandstone and reflecting surfaces composed of a mosaic of marcasite or iron pyrite crystal segments, small human figurines, and carved bone implements.

It is unfortunate that so little archaeological work has been done in the northern part of Mexico, and for that matter, in south-central Arizona and New Mexico. For the small number of sites partially examined, there are literally hundreds which are yet untouched, or destroyed by cultivation of the fields in which they lie. However, through the excellent work now being done by the Gila Pueblo, of Globe, Arizona, more revealing evidence may soon be given to students.

It is my personal opinion that the roots of the Hohokam culture of southern Arizona extend deep into Mexican soil. I feel that the Sonora and Arizona phases of this material are the northern developments of a culture which flourished several hundred miles south and west of the areas in which we now find the evidences. It would seem that the Hohokam manifestations may be far flung outposts of that southern culture, carried north on a reflex wave of infiltration that brought with it certain arts and crafts into the southern desert area. With this culture may have come corn and cotton, the practice of cremation burial, the paddle-and-anvil method of making pottery, and the art of mosaic work in stone on shell, wood and bone.

I might also postulate the theory of a second stream of culture flow-

ing northeast, extending across Texas, Oklahoma, Arkansas and Missouri into Tennessee, Georgia and Alabama, thence into Ohio, Indiana, Illinois and throughout the Mississippi valley.

Nor do I believe these main streams emanated from a single central source; rather they were created from a number of small, isolated springs of Mexican culture, all feeding contributory elements into the parent body. These were the scattered communities. Even as Tenochitlan under the Aztecs became a powerful center of borrowed culture, so did the Gila and the Mississippi valleys become the ultimate centers of the northward streams of Mexicanized cultures, which in turn diffused in various directions.

Eventually, I believe, more and more sites bearing evidence of this southern affiliation will be encountered in Oklahoma and Texas, separated perhaps by certain wide gaps due to the presence of wandering, fierce fighting plainsmen who acted as a living barrier to settlement in certain regions. Then perhaps, still theorizing, other, culturally related sites will be found in the northeastern areas of the Mexican states of Coahuila, Nuevo Leon, Tamaulipas, Vera Cruz, Zacatecas and San Luis Potosi. South of Arizona, I am inclined to think that actual settlements bearing evidences of the cultures that gave rise to the Hohokam will be rather scanty in Sonora and Chihuahua. I am not convinced that they will be entirely absent, but I suspect that Sinaloa, Durango, Nayarit, Zacatecas, Jalisco, Michoacan, Guerrero and Oaxaca will prove more fertile fields for the villages that produced the elements of Hohokam culture.

I suspect that the arid, rough country of Sonora and Chihuahua may have been peopled with a living barrier of semi-nomadic tribes that opposed the settlement or even the passage of southerners through their territories. For that reason our evidences of prolonged occupation of those regions by peoples of the Hohokam stock may be rather scanty, and if found, may be located in isolated spots on small water courses, or near springs not frequented by the regular inhabitants of the region. My own experience in the location of sites in the Gila valley has taught me that villages, large and small, are often found situated in what are now barren, waterless stretches, and can only be discovered by the most diligent search.

When one travels in Arizona or Sonora by the usual roads, one is impressed by the immense stretches of country which, although forbidding in appearance, were once inhabited by a fairly large number of Indians. Furthermore, considering the rather cursory surveys of the re-

gion that have been made, and the vast expanse of terrain over which an archaeological survey would have to be conducted, it will be many years before we can hope to answer the numerous questions raised by the various sites similar to that where the shell bracelets were manufactured.

Types of chipped points found on the Boquillas or La Playa site, and five smaller specimens picked up among the ruins of the quarters of the neophytes of Santa Teresa mission, in the Altar valley north of the town of Atil, are shown in Plate 8, Figure 2. The largest specimen, $2\frac{1}{8}$ inches long, is a dull purplish color, made of a tough, chert-like rock which fractures unevenly. The other points from Boquillas are similar. Comparable specimens were found in 1931 on a site midway between Florence and Tucson, Arizona, by the Van Bergen-Los Angeles Museum party. At that time we suspected, mainly by a process of elimination of known types from the Southwest, that they originated somewhere to the south. The five small points from Santa Teresa are of chert and obsidian. These, are possibly Apache in origin, used during an 18th century attack upon the neophytes' quarters of that mission. The mottled chert point is the largest, being three-fourths of an inch long. The smallest is nine-sixteenths of an inch in length.

I have mentioned these types of chipped artifacts simply to illustrate one of the points I wish to make, that the task of untangling the various elements comprising the cultures of northern Sonora will not be an easy one, and that pottery alone will not serve as the sole determinant of such cultures. Everything must be taken into consideration: houses, stone, bone, shell and pottery, artifacts, and modes of burial. Historic documents will prove invaluable in running down clues, but our prehistoric data will be obtained largely from the scanty material remains found at the sites.

THE ARCHAEOLOGY OF LUDLOW CAVE AND ITS SIGNIFICANCE

W. H. Over[86]

THE ORIGIN and culture of the older archaeological material taken from Ludlow Cave, Cave Hills, Harding County, South Dakota, in July, 1920, has been subjected to some discussion and speculation. The cave was named after William Ludlow, Chief Army Engineer of the Department of Dakota, who visited it in 1874 while accompanying the Custer Expedition from Fort Abraham Lincoln to the Black Hills.

The cave is located in the northeast quarter of section 12, township 21, range 5 W, in the extreme northwest corner of the state in the Sioux Forest Reserve. Geologically, it is in the Ludlow Division of the Laramie formation, Upper Cretaceous Period. It is irregular in shape, extends back thirty-nine feet, and is sixteen feet wide and ten feet high. The entrance was partially blocked by rocks, each weighing several tons, which had fallen from above.

Extending back from this room for sixteen feet there is a narrow passage ten feet high and four feet wide, which decreases to about fifteen inches in width in some places. It winds back for 164 feet, where the fissure makes it necessary to crawl on hands and knees to reach the end at 294 feet. This fissure extends in a southeasterly direction and seems to follow a ridge on the surface.

Continued erosion over a long period has worn down the soft sandstone, enlarging the room and at the same time building up the floor. At the time of our work, the filled-in floor was approximately three feet deep. How long it took to build up this deposit is problematical. It seems apparent that man was the first occupant, since charcoal, ashes, fragments of bones of some larger mammals, arrows, bone tools, and ornaments were found upon the original floor, three feet below the surface deposits. The upper six inches contained much rubbish, carried in by small mammals, or blown in by winds. Mingled with this was the excrement of bats, chipmunks, packrats, mice, birds, cattle and sheep. The latter two ventured in during severe winter storms. The skeleton of a two-year old steer was found in the narrow fissure, where it had probably become wedged. Also in the upper six inches were porcelain beads, steel arrow points, brass finger rings, and wristlets, typical relics of the Sioux Indians during the period from 1800 to 1850.

[86] Director, University of South Dakota Museum, Vermillion.

Arrowheads from Ludlow Cave. One-half actual size.

FIG. 1.—Beads and pendants of shell and bone, from Ludlow Cave. Three-fourths actual size.

FIG. 2.—Fragments of basketry and a chipped-stone blade, from Ludlow Cave. Two-thirds actual size.

If at a rough estimate it took about a hundred years to form this layer, one may arrive at some conclusion regarding the length of time it would take to build up the lower thirty inches with debris, other than that left by man who lived for a short time on the original stone floor.

Our party began at the entrance and screened the whole floor with a quarter-inch mesh. A few steel arrow points and brass rings belonging to the upper, or Siouan period of occupancy were found by screening in the fissure. At first no evidences of prehistoric occupancy of the cave were discovered. Then, at the twenty-six inch level, about a dozen bone awls, a few bone chippers and some charcoal and ashes were found near the entrance. On the thirty-six inch level, just above the original floor of hard sandstone. numerous very small arrow points were uncovered. About three hundred were of a general type occurring in South Dakota. All were thin and well finished, although some barbs and points were broken. The material is chalcedony, agate, flint, and some fine-textured quartzite. Only three were of triangular shape. The sinews that fastened the points to the shafts were still intact around the base of shank of a dozen arrow points (Plate 10, upper right). Several broken arrow shafts were found.

Fragments of three pipes, one of catlinite, one of black pipestone, and one of wood with about half of the bowl remaining, were mingled with the chipped points. Several potsherds, tempered with burned crushed granite, were not comparable with either Arikara or Mandan pottery. Pendants included perforated clam shells and three elk tusks. Beads were of shell (Anculosa, Dentalium, and *Campelona integra*), native copper, bone, and gypsum. The most numerous were made from the leg bones of birds, from one- to three-quarters of an inch long, and occasionally highly polished. A few bones were found partially cut, apparently indicating that some beads were made at the site (Plate 11, Figure 1). Several beads were made of plum and chokecherry pits.

Many small fragments of flint and quartz, with corners worn smooth were found at the site. These may have been used for games. A triangular-shaped dagger or knife of brown chalcedony still retained over its base the black pitch with which it had been fastened to its handle. Other than this, no stone implements were found.

Two small bits of woven reeds, probably parts of a basket or moccasin, represent the only evidence of woven material found in South Dakota as far as the writer is aware (Plate 11, Figure 2).

A row of rock piles near the mouth of the cave on the talus slope east of the entrance was carefully examined with negative results. A few arrow points and some bone beads were found by screening part of

the floor of a smaller cave at the extreme southeast point of Cave Hills. This is known as Pelhams' Cave.

On each side of the passage leading back into the fissure were two crude faces of human beings. One had been badly defaced, but the other had fallen face down on the floor and was preserved. It was ex-

FIG. 4.—Petroglyphs on canyon wall near Ludlow Cave.

cavated and removed to the University Museum. Petroglyphic figures had covered the walls but, due to erosion and defacement, were difficult to identify.

On the cliff across the canyon from the cave entrance were some well-preserved drawings (Figure 4). We are assuming that the people who lived on the original floor of the cave carved the figures on its wall and on the cliffs opposite. The petroglyphs apparently represent the footprints of some two-toed mammal and resemble others found on the surface of flat sandstone fifteen miles northwest of Mobridge and a hundred and fifty miles east of Ludlow Cave. None of these resemble the human hand and footprints, and bird tracks pecked on granite boulders found near the Missouri River in the northern part of the state.

The older archaeological material from Ludlow Cave may have been deposited by some group of the Rocky Mountain region who were buffalo hunters, perhaps the Shoshoni, when they ventured eastward on the plains and spent a short period in the cave. The presence of so many arrow points and animal bones, and the absence of domestic articles would indicate that the period of habitation was temporary. Nor is the presence of a few plum and chokecherry pits conclusive evidence that these people were here when the fruits were ripe. They could have been procured from the winter stores of mice and chipmunks.

From our present knowledge of the archaeological sites, it is obvious that the Cave Hills region should be further investigated.

In the article, *The Buffalo Drive*, by Barnum Brown,[87] are two plates showing a collection of points taken by Mr. Brown in the talus slopes where Indians had driven buffalo over cliffs. The location is between Livingston and Gardiner, Montana. Mr. Brown leaves the inference that this was the work of the Shoshoni Indians. A comparison of the two lots shows such evident similarity that one is forced to the conclusion that they must have been made by these or closely related Indians. It is not the intention of the writer to emphasize the theory that determining culture by comparing arrow points should be taken too seriously, but in instances such as cited here, it is a factor that cannot be ignored.

The severe wind and dust storms which prevailed over cultivated fields of the eastern half of South Dakota during the last few years, have exposed to view many thousands of a type of arrow points that was little known before. These points have previously escaped observation due to the fact that erosion by washing does not occur on the level prairie. The points are usually dark in color, and about fifty per cent of them were made of a translucent chalcedony. The workmanship manifested in these points, which were lost by early Indian buffalo hunters on the plains, is greatly inferior to that of points found eastward and usually attributed to early moundbuilding Indians.

While the similarity between these points and those from Ludlow Cave is not as striking as that between the latter and those from the cave in Montana, I am led to believe after examining many collections, that further study will establish the fact that the origin of these prairie points was with western Indians whose early history has not heretofore been associated with South Dakota territory, and that the Ludlow Cave material may be found to be pertinent to this problem.

[87] Journal of the American Museum of Natural History, Vol. XXXII, No. 1, pp. 80–81, Jan.–Feb., 1932.

CORRESPONDENCE

Apology

Most unfortunately, there was dropped from the proof of "The Pottery of Pecos" a statement which was included in the manuscript, acknowledging my deep indebtedness to Mr. F. G. Hawley of Miami, Arizona, for chemical analyses of glazes, made by him at my request. In the same lost paragraph acknowledgment was also made to Dr. Sigvald Linné of the Royal Ethnographic Museum of Stockholm, who also arranged to have analyses made for me in Sweden.

A. V. Kidder

Mountain Sheep Effigies

During the summer of 1935, while the author was a resident of Prescott, Arizona, as Curator of the Smoki Public Museum, the remains of what had once been a large walled compound of prehistoric times were excavated.

The location of the compound was but an approximate two miles from the center of the city of Prescott, and within the northern border of the fenced area known as the Fair Grounds, or Rodeo Field. About one-third of the ruined structure remained when excavation began. The rock and accumulated debris had been, during a period of forty years, a source of filling material for bridge approaches, house foundations, rock walls and well linings. The credit for preserving what remained of the compound until careful excavation could be made is due to Miss Grace Sparkes, Secretary of the Yavapai Chamber of Commerce, who influenced the withdrawal of a tractor and steam-shovel then at work levelling the remaining walls of the compound, and to the Smoki Public Museum for aid in excavation.

Perhaps it would be well to mention briefly the nature of the compound as it was revealed through the excavation. A large wall of cyclopean construction, twenty-four inches thick on the average, seventy-eight by fifty-six feet in length and breath dimensions, composed the original rock-wall structure. What the original height of the walls had been would be a conjecture, but seems reasonably to assume they were sufficiently high to afford protection in case of attack. The highest portion uncovered in the north section of the wall, was four and one-half feet. On the south, east and west sides only the wall outlines appeared; these were from six to sixteen inches high. No cross walls were uncovered on the original level within the compound. These compound walls in the direction of greatest length were approximately thirty degrees west and east of true north and south, respectively.

At the northern end and within the main walls, two walls at right angles to the former and of later masonry construction were encountered with foundations some thirty inches above the compound wall base. The rocks used in these secondary walls seemed to have been laid up in a well-mixed clay mortar and in

regular courses, with both inner and outer faces quite smooth and regular. This could not be said of the compound walls, of which the outer face was quite even, but the inner surface rough and irregular, some of the rocks extending three to six inches beyond the face of the wall. This feature may have offered an advantage to one scaling the wall from the inside.

Pottery fragments were found in profusion throughout the soil removed. The majority of these sherds were of plain ware, some very coarse. In addition, there was found a considerable quantity of coarse gray ware, crudely designed in black, which has been designated as Prescott black-on-gray, because of the evidence that this pottery originated in the region of Prescott. In smaller

FIG. 5
Copyright 1935, Smoki Public Museum

quantities appeared the black-on-red, black-on-white and red-on-bluff sherds; these apparently were not on the compound wall base level, although it was very difficult to determine with any degree of certainty because the soil had been so greatly disturbed. It would seem plausible, however, that these latter sherds are to be associated with the occupancy of the upper wall structures.

To the east of the walled compound a crude structure was uncovered of the Transitional Pithouse type, and in this two charred ends of supporting poles were found which, so far, it has not been possible to date by the Douglass Tree-Ring Method. On the floor area of this structure, which measured twenty-three by ten feet, three metates were uncovered; two were of the irregular trough type, and the third and largest was of the regular trough type. The floor, level was of well-defined and hard-packed red clay.

The real find of the Fair Ground Excavations, however, was made just outside the north wall of the compound. Two heads of mountain sheep, cut from sandstone, proved to be of outstanding interest (Figure 5). These heads are carved from what seems to be Yavapai sandstone, a material peculiar to this immediate area; this fact would indicate that the heads were made in the immediate vicinity, perhaps on the site of the old habitation within the walls of the compound.

The soil surrounding the compound walls where the rams, heads were unearthed, and within their confines, was very black, apparently containing burned organic matter. Each figure was discolored over an area extending from the base to within eight inches of the top, offering the appearance of having been through fire. Outside this area, which was the portion buried beneath the floor or soil level, the heads were of the natural sandstone color.

The horizontal distance through each head from the outside of one horn to the outside of the other is approximately ten inches. The greatest vertical length measurement is fifteen inches in one figure and eighteen in the other.

These mountain sheep heads, curious specimens of the carving of early inhabitants of the Prescott region, are now on display at the Smoki Public Museum in Prescott, Arizona.

MALCOLM B. CUMMINGS
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CREDIT TO PREVIOUS INVESTIGATORS

In the April number of AMERICAN ANTIQUITY, there is an excellent article by Dr. E. E. Tyzzer on bone points from shell heaps in Maine, which I read with great interest. I have no desire to criticise Dr. Tyzzer's excellent work, yet I think it is proper to express regret that there is no mention in his bibliography of the many seasons which I spent in the exploration of Maine shell heaps. In our book, *Archaeology of Maine*, I devoted fifty-four pages to this subject, illustrating many of the bone points described by Dr. Tyzzer in his article. Those who read his article will naturally conclude that very little work has been done along the Maine coast except by the gentlemen whom he has named. There is a large collection of these points in the Andover Museum. That some of them were used as tips to arrows I do not doubt; others, however, we believe were fish-hooks. They could be fastened as was done on the Northwest Coast, and used effectively for the taking of halibut, cod and other large fish. One of my men made experiments in line with this interpretation many years ago, and was able to catch a few fish with these points.

I trust readers will pardon me if I state that much of my life has been spent in studying chipped objects and their use. I firmly believe that Indians favored, for hunting, a broad stone or bone point rather than slender bone points. The Indian was primarily interested in killing large game, and he knew that a broad or rather heavy arrow point of stone made a larger wound, thus

causing considerable loss of blood and weakening the animal. Furthermore, Indians did much of their hunting in winter. By means of snow shoes, they approached deer or moose, particularly in deep snow, and were able to use, at close quarters, spears or lances. In addition to spears, they carried their bows and arrows.

I would suggest that our present day writers or investigators, while presenting observations in more detail than appeared in reports published years ago, be careful to accord credit to previous explorers. This would in no wise detract from their able and valuable dissertations.

I might remark in passing that in fields other than New England there have been—probably inadvertently—omissions of reference to previous investigators work and reports.

This summer, in Maine, I met a gentleman who has hunted big game here, in Africa, and elsewhere. I also talked with one or two persons who had served with us on previous expeditions and are familiar with game and local conditions in this state. We discussed the use of short worked bones as arrow points. They approached the subject from the viewpoint of the hunter and practical woodsman. The fact that these bone points are confined to shell heaps along our coast from eastern New Brunswick to Portland, Maine, is very significant. They are not found at sites in the great hunting regions of central Maine, Penobscot, Kennebec, and other valleys. Were they used primarily for the killing of game we would find them in village sites, ash pits, etc. Yet they do not occur beyond the shore line where are clam flats and the larger salt water fish.

Projectile points of stone are found in great numbers in the interior, up rivers, and also occur in many shell heaps.

With reference to the killing of big game by primitive man, one's mind reverts to an experiment performed by us in a slaughter-house at Methuen, Massachusetts. I am sorry that these observations did not receive more publicity. They were based on the contention of a practical hunter to the effect that the palaeolithic "fist axe," of Chellean type, could not be used effectively against large game, as borne out by his and our experiments on living and dead animals.

The parallel between this and the use of slender projectile points is not exact, yet the principle is practically the same.

I have no desire to criticize our able scholars who are engaged in laboratory experiments, but I do believe we should approach this general subject from the point of view of the Indian hunter. His "outfit" varied according to necessity. The bone points in question are fashioned from the bones of large animals rather than those of birds, and seldom of the seal. However, while the bones so utilized are *in situ* at the kitchen middens, the points themselves are absent back from the coast where the large animals were hunted.

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The Birdstone and Its Probable Use

Among the many problematic slate forms of contemporaneous American Indian culture, probably none have been so commented upon as the birdstones. With few exceptions these are all well made, graceful, and excel any of the other slate forms in this respect. There is nothing to associate the bird form with any existing belief or custom of the American Indian of today.[88]

Most birdstones are found in an area embraced by the states of New York, Ohio, Indiana, Michigan and Wisconsin. They are of course found in other states, but seem to have their focal point in the states mentioned. These states, as will be observed, are all in close proximity to or bordered by the lake area, or contain extensive waterways. I make distinct note of this for it is important to the theory to be advanced.

The variety of materials from which birdstones are made seems to be restricted; banded or Huronian slate predominating over other grades or slate, sandstone and granite. They have many characteristics in common, such as the method and angle of perforation, the straight, slightly curved or saddle base, absence of file marks, development of the so-called eye, and the final finish of the completed object.

Warren K. Moorehead, in *Stone Ornaments of the American Indian*, divides birdstones into six classes as follows (p. 81): (*a*) the ordinary bird-stone; (*b*) the birdstone with slender body, neck and head specialized; (*c*) birdstone with short body; (*d*) short, wide birdstone, southern type; (*e*) birdstone with wide body and large ears; and (*f*) the variations of another type.

The theories advanced regarding their probable use are many, wide and variable. Henry Gilman, Smithsonian Rept., 1873, says, "they are worn on the heads of Indian women but only after marriage"; and William Penn says, "when the squaws are ready to marry they wear something on their head to indicate the fact." Some authorities have presumed that the birdstone was referred to in this case. If this were true, Penn would undoubtedly have mentioned it; certainly something as distinctive as the bird form would have been noted. The mere wearing of a head ornament to indicate the status of a person before or after marriage is a common trait among the more primitive peoples of the world, and is practiced today. To cite a specific instance; the maidens of the Pearl Island group wear a red hibiscus blossom over the right ear when foot-loose and fancy-free, and after the marriage wear the flower over the left ear. In some European countries, certain methods of dressing the hair, or the type of headgear worn are used to indicate the marriageable status of the person in question.

Jones, in *Antiquities of the Southern Indians*, quotes De Bry as saying, "the Indian conjurors wore a small black bird above one of their ears as a badge of

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[88] Editor's note: Mr. Allen's article, "Significance of the so-called Bird-Stone," this series, Vol. 1, No. 3, p. 224, was printed after the present article was received.

office." I remark at this time that De Bry makes no mention of what this bird was or of what it was made. No doubt he was referring to a custom which was prevalent among the medicine men of some of our Indian tribes within recent times, and which entailed the removal of the entrails of a bird, the curing of its body and the wearing of it in their hair as part of the regalia of office. Lafiteau (Vol. III, p. 50) says, "On solemn occasions, as on gala days, the Iroquois wore above the ear a tuft of feathers or the whole skin of some rare bird"; while Adair (p. 81) notes the same custom among the southern Indians.

Dr. William Beauchamp, Bulletin of the New York State Museum, Vol. 14, No. 18, 1897, says, "It seems better to class them (the birdstones) with the war and prey or hunting gods of the Zuñi, some of which they resemble." There is no question as to their resemblance but here the likeness seems to cease. Among the great number of fetishes collected and commented upon by Frank H. Cushing in the Annual Report of the Bureau of American Ethnology for 1880–81, it is well to note that among the objects illustrated and described, none of them compare in essential points with the bird forms. The birds follow distinct lines, with certain minor variations. After examining hundreds of them, it becomes evident that they were manufactured with a definite purpose in mind and adhered to certain standard patterns. This cannot be said of the Zuñi fetishes.

Another theory previously advanced, and one which this letter seeks to substantiate, is that they were used as canoe-prow ornaments. Charles E. Brown, in the *Wisconsin Archeologist*, Vol. 8, No. 1, presents a map showing that in Wisconsin birdstones were most numerous along the shore of Lake Michigan, using this as an argument that their distribution was influenced by trade routes. To my mind the trade-route supposition is feasible to a certain degree, but we must remember that trade routes were not confined exclusively to waterways. It is well to note that the western shore of this lake does produce many specimens of this form, and I make more then a passing note of this fact. From earliest historic times this shore has been under the control of the Winnebago, who used canoes. It is interesting to note that while the shore of Lake Michigan and the lake portion of Wisconsin have produced the birdstone in great numbers, New York and Ohio, particularly in the lake and waterway area, and Indiana, have also produced an unusual quota of the bird forms.

I believe that the development of the birdstone along with certain other ceremonial forms of polished slate, is a cultural manifestation of the Iroquoian tribes, introduced by them and accepted with certain modifications by various tribes with whom they came in contact. This theory is of course suppositional on my part, yet it is substantiated to a degree by the great number of polished slate objects found in the localities of strongest Iroquoian influence. For example, the territory lying between the Youghiogheny and Monongahela Rivers, in Pennsylvania, containing hundreds of square miles and uncounted village sites, all of archaic Algonkian occupancy, shows a negligible quantity of the bird

forms, and very few of the problematic slate forms. When found, these objects are generally very crude, apparently copies of the better polished slate forms. These sites were evidently occupied and abandoned many years before the Iroquois had started on their wars of conquest in this territory. At that time only slight contact had been made by the Iroquois with these people. In the Allegheny River valley, where the Iroquois and Delaware had fought and driven from this territory the legendary Allegwi, the occurrence of these objects is not uncommon on sites subsequently occupied by the Iroquois.

C. C. Abbott, in *Primitive Industry*, p. 372, says, "On the bluffs forming the eastern bank of the Delaware River, south of Trenton, N. J. on the site of one or more extensive Indian towns, fractions of these stones in great numbers have been found, a few are only blocked out." Here we also have a great waterway area. You will note in the preceding paragraphs the states mentioned and the great number of these objects produced. It is pertinent to the canoe-prow theory that these are lake states and abound in waterways. The primitive inhabitants were for the most part of Iroquoian and Algonkian stocks, both of which groups used canoes. The area is also the center of the thunderstorm section. What more logical supposition could be advanced than that the people living in this area, bound by certain religious beliefs and seeking constantly to placate the spirits causing the storms—the thunder birds, and at the same time desiring to protect their lives and property, would attach to their canoes an image of the thunder bird as they presumed it to be? The reactions of primitive minds to natural phenomena are in the majority of cases identical, irrespective of racial characteristics or geographical separation. The Solomon Islanders follow a similar practice for the protection of their canoes. Instead of the thunder-bird, the frigate bird is used and endowed with certain human characteristics. The frigate bird, no doubt, was selected for its almost supernatural ability to rest upon the water irrespective of storm or calm.

The canoe-prow theory would account for the rarity of birdstones in the burials of these peoples, including the mound builders. First, the Iroquoian people, if accepted (as they are by many students) as those who drove from the mound district the builders of the mounds, most naturally would not have left a product of theirs within the mounds. Second, had the birdstone been an article of personal adornment, or a warfare or hunting fetish, it would be found in the graves of those who made it. But if attached to a canoe, it would be lost when the canoe was lost or, if preserved, transferred to another bark. The holes in the base of the object would simplify attachment to the canoe, while freedom from excessive wear in the holes, showing that they were firmly attached, as well as their unmutilated condition, except as caused by the finder, would further tend to strengthen the canoe-prow theory. Additional substantiation is found in the almost total absence of these objects at sites of plains or desert inhabitants.

Birds shaped of wood, in no respect akin to the birdstones, have been noted

attached to the grave posts of certain Algonkin tribes. This may be a further development of the thunder-bird idea.

Isolated cases have been noted of the finding of birdstones in the stone-grave burials of Tennessee, although the rarity of their occurrence would not make this an important factor in the canoe-prow theory.

RALPH H. WHITEHEAD
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STOPPERS OR MODELING TOOLS

In an article entitled *Various Implements of Earthen Ware*, Bureau of American Ethnology Annual Report 20, pages 35–36, illustration and mention are made of what the writer calls "trowel like objects of baked clay which are occasionally found in the central districts of the Mississippi valley."

He further states, "When placed stem downward these implements very closely resemble an ordinary form of toadstool. They have been regarded by some as stoppers for bottles but this was certainly not their normal use, and General Thruston is probably right in classing them as modeling tools for pottery making."

In my collection I have a pottery water bottle which was found with a stopper in place, shaped like a toadstool. These specimens were found at Bone-Bank, an ancient village site situated on the banks of the Wabash River, Posey County, Indiana.

I have heard questioned the opinion of General Thruston that these toadstool-shaped objects were not normally used as stoppers for bottles, and I should like to hear the opinion of some interested students.

THOMAS J. DILLINGHAM
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"CELL-TEMPERED" POTTERY

In AMERICAN ANTIQUITY, Vol. 1, No. 2, pp. 152–153, the Editor quotes a report on "cell-tempered" pottery by J. O. Everhart. Dr. Everhart points out the facts that calcite can be positively identified optically by refractive indices, that it is subject to solution by acidulated ground waters, and that the shape of the cavities in the pottery is such as would be formed by shell fragments but not by any of the other forms in which calcite occurs. As long as some material remains in the cavities it should, therefore, be a simple matter to prove whether or not the "cell-tempered" pastes are in reality only shell-tempered pastes which have been subject to leaching.

Dr. Everhart's suggestion regarding the original mineralogical composition of the shell, and his explanation of the spalling of the sherds call, however, for demonstration. The statement that "Most marine shells are composed largely of aragonite—" is insufficient basis for supposing that these particular shells

were composed of that mineral. Presumably they were fresh-water shells. Milner[89] reports that "*Lamellibranchia* vary, certain genera (*e.g.*, *Trigonia*, *Pinna*, *Spondylus*, *Unio*, etc.) exhibiting an inner shell-layer of aragonite, the outer being of calcite; *Ostrea*, *Pecten*, etc., are entirely of calcite; otherwise many forms are composed of aragonite." Clearly the mineralogical form of the calcium carbonate in the particular kind of shell under consideration should be determined.

The suggestion is made that spalling was caused by the inversion of aragonite to calcite. The statement that "This alteration is accompanied by a volume increase of 10 to 15 per cent—" requires elucidation. If the increase in volume is calculated on the basis of the specific gravity of the two minerals, values of 7.9 and 8.5 per cent are obtained, taking the specific gravity of calcite as 2.714, and the extremes of aragonite as 2.93 and 2.95, as given in Dana's *Textbook of Mineralogy*. Rosenbusch[90] gives a specific gravity of 2.714 for calcite and 2.937 for aragonite; Winchell[91] and Larson[92] both give 2.715 for calcite, and 2.94 for aragonite.

Available experimental data may not show conclusively how much pressure low-fired clay bodies will withstand. There is, of course, a direct relation between compressive strength and the temperatures of firing together with the refractoriness of the clay, but again the answer to the question is to be found by experimentation. When a clay body having the same materials and the same grain size and amount of temper as were used by the primitive potter is fired within the potter's temperature range, does it spall?

It is common knowledge that the calcination of calcium carbonate, and its subsequent hydration, which results in a 30% increase in volume, causes serious spalling. Thus heavy calcite tempering, overfired, will cause the complete crumbling of the vessel wall. The decomposition of calcium carbonate takes place over a considerable temperature range. It commences very slowly at a relatively low temperature, slightly above 600° C.[93] There is, therefore, always the possibility of partial calcination of the calcium carbonate to consider as an explanation of spalling.

The term "cell-tempered" or "hole-tempered" as applied to pottery is doubtless a convenient misnomer. It does, however, suggest a distinct class of material. If these specimens are only leached sherds of shell-tempered pottery, as Dr. Everhart seems satisfactorily to have demonstrated, the advisability of retaining the name might well be questioned. Observations as to the soil conditions under which this kind of pottery is found, of the varying degree of solu-

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[89] Sedimentary Petrology, London, 1929, p. 309.
[90] Mikroskopische Physiographie
[91] Elements of Optical Mineralogy
[92] Determination of the Nonopaque Minerals.
[93] Wilson, Ceramics, Clay Technology, pp. 154–155.

tion of the material in the cavities, and comparison of the clay in this and shell-tempered pottery would seem pertinent to the study.

ANNA O. SHEPARD
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METALLOGRAPHIC STUDY OF COPPER ARTIFACTS

The clear exposition by Wilson and Sayre of the metallographic study of primitive copper work, AMERICAN ANTIQUITY, Vol. I, No. 2, pp. 109–112, must impress the archaeologist as presenting a precise and valuable means of extending our knowledge of this primitive industry. Although the archaeologist recognizes that the application of the method requires training in the microscopic study of opaque minerals, and that analyses should be undertaken by the specialist, he is none the less interested in the details of the technique and in the limits of its accuracy, in order that he may better judge the extent of its application to his problems. One would like to know, for example, more about the significance of twinning in copper. The following quotations suggest the need for further explanation:

"Twinning always shows that the copper has been mechanically worked and then annealed" (p. 111).

"This spearhead was hot-worked, at a bright red, about 800° C., and thoroughly annealed after being worked. The evidence for these conclusions is: large, equiaxed grains, showing good annealing; twinning, indicating mechanical working" (pp. 111–112).

"This arrow-point was hot-worked, the work ceasing at about 500° C., not followed by annealing. The evidence for this is the occasional twinning, the different sized grains, and the unequal axes of many of the grains" (p. 112).

"This axe was hot-worked, followed by good annealing, but at relatively low temperature, about 500° C. The evidence for this is the equiaxed grains, with some twinning, with uniform grain size throughout, but with all grains small" (p. 112).

"This nugget was heated, allowed to cool, and then cold-rolled. The grains are elongated, without twinning, proving that the metal was not annealed after having been worked" (p. 112).

The occasional twinning in a specimen that was hot-worked but not afterward annealed seems a contradiction of the general statement that twinning always shows that the copper has been mechanically worked and then annealed. But perhaps the effects of hot-working without subsequent annealing are comparable to cold-working followed by annealing. If so, how are the two methods of workmanship distinguished, by the shape of grains?

It would also be of particular interest to know how close is the correlation between size of grain and temperature of heating; if it is reported, for example, that an implement was "annealed at about 500° C.," what are the limits above

and below this temperature implied by the word "about"; are they in the order of twenty-five one hundred or more degrees? How is the time distinguished from the temperature factor; that is, how is the effect of long heating at a relatively low temperature differentiated from the effect of shorter heating at a higher temperature? Considerable variations are expected in primitive craftsmanship. We accept them as the indications of inexact methods. This fact, however, does not lessen our concern in the limits of quantitative accuracy of our analytical technique.

While the answers to these questions are doubtless obvious to the metallurgist, the general archaeologist, unfamiliar with the fundamentals of the investigation, must be eager for more information. The significance of the data afforded by the method would seem sufficient to insure its wide application in archaeological investigations.

ANNA O. SHEPARD
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SURVEY METHODS

While not wishing to detract from Mr. Robbins' laudable idea of an acceptable method for the designation of archaeological sites through the use of the U. S. Topographical Survey sheets, as presented in the January issue of this journal, it seems only fair to call his attention to the fact that such a system, with the detail sheet giving the essentials of the site listed, and available specimens, was inaugurated by Mr. Harold Gladwin of the Gila Pueblo, Globe, Arizona, early in 1928. In November, 1928, Mr. Gladwin, then residing in Pasadena, California, published a small brochure entitled, *A Method for Designation of Ruins in The Southwest*, which was "Privately Printed for The Medallion, Pasadena, California."

In this item is described the method mentioned by Mr. Robbins. In subsequent publications which have been issued from time to time by the members of the staff of the Gila Pueblo, this method has been used and seemingly has proved very satisfactory. The detail sheets upon which the archaeologists of the Gila Pueblo keep their field records are of a necessity more varied than those which Mr. Robbins might keep in New England.

It is interesting to note that two men who have come into the archaeological field after browsing in other pastures, men who have probably not contacted each other, and who live on opposite sides of the country, have hit upon the identical method for making archaeological surveys. We need more such interested students.

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The Looping Technique in Netting

In the January issue of American Antiquity, Volume I, Number 3, a paper by Mr. Horace Miner states on page 185, "As *knotted looping* implies, the loops are held intact by the knotting of the strand (Figure 3, No. 6c). The loops themselves, however, are not knotted onto the preceding row of loops, but are free to slide along the segment of cord over which they are looped.

"(D) *Netting* is the actual knotting of one row of loops onto the preceding row (Figure 3, No. 7). There is not, therefore, the small amount of movement between the loops typical of all other types. Their junction is fixed and definite" (p. 185).

I should like here both to ask a couple of questions and to offer a criticism. Is the *knotted looping* mentioned by Mr. Miner made in the same way as *plain*

a *b*

Fig. 6

looping, otherwise called simple looped knotless netting, except that instead of a loop a knot catches the preceding strands, as shown in Figure 6, a, with the same strand making a series of knots, one over each segment of cord separating the knots of the previous row? Also, what kinds of knots are utilized in this *knotted looping?*

One point of my criticism hinges somewhat on the answer to the first question. Should the answer be in the affirmative, I have no argument on this point with Mr. Miner as to the terminology used. If, however, the technique is similar to that used in the modern manufacture of nets, employing the *fisherman's knot*,[94] a finger-knot through which has been slipped another cord, which in turn is used in finger-knots which alternate with loops of the first row, I feel that Mr. Miner has established an artificial and unnecessary differentiation be-

[94] Scout Handbook for Boys, p. 76, knot 8.

tween this and his *netting* category. If the *fisherman's knot* (Figure 7, b) is to be placed elsewhere than under the *knotted looping* category, where would it fit? By Mr. Miner's definition, it could not be considered *netting*, since, to qoute him, in *netting* "There is not, therefore, the small amount of movement between the loops typical of all other types" (p. 185) and the *fisherman's knot* does allow some slight movement between the loops. In fact, the easiest and quickest way to identify a *fisherman's knot* is to try to slide the knot along the loop strand. If the knot slides, there is a fine chance that it is the *fisherman's knot*. It has invariably been found that this proves true on more careful analysis. Why shouldn't such a knot be included in *netting?* By definition,[95] netting is "A piece of network; any fabric of crossing cords, threads, ropes, wires, or the like, with open spaces between." A net made with the *fisherman's knot* would fill that definition as well as would one made with the *sheet bend knot*. So, for that matter, would the various types of *looping*, so why not call the latter *knotless netting*, as has been done on occasion, and avoid a superfluity of terms?

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ON POTTERY RESTORATION

The presentation of the process described here has two purposes: (1) it is a pottery restoration process which can be used in small museums and laboratories limited in personnel and equipment; (2) it is hoped that this will encourage others to report on some of the simpler laboratory techniques in the "Correspondence" section of AMERICAN ANTIQUITY.

It is essential in this process that enough of the vessel be represented to show at least one-third of the curve of rim and body. When related sherds have been mended to form a single piece, the entire surface is covered with liquid soap, or a similar agent, to prevent the plaster of Paris, used as explained later, from adhering to the surface or in the lines of mending. When carefully covered by this film, the piece is placed to stand upright on its rim. Thus the plane of the table on which it rests becomes the plain of the rim, and the angle with this plane assumed by the walls of the vessel accurately determined. Then plaster, just thin enough to prevent air bubbles, is poured on the surface. The mold should be so made as to be easily removed after hardening. With this precaution observed, the mold may be built up to a thickness sufficient to insure against breakage in handling. It may be necessary to make the mold in two parts, depending on the amount of curve characterizing the pottery walls.

When the mold has become thoroughly dried, it should be removed with little effort. It is then placed on a sand-table, or in a position so that the entire inner surface is exposed. This surface is also thoroughly covered with the soap

[95] Webster's International Dictionary of the English Language (unabridged), 1929.

separator. Then plaster is poured into the mold to produce a cast of the partial pot. Caution should be observed to make the cast as nearly the thickness of the pottery as possible, and to facilitate the easy removal of the mold.

While the cast is drying, the operator may continue his work by finding the circumference of the mouth of the original pot. The outside of the rim is traced on a piece of paper upon which the pottery section is resting, rim down. A flat pencil is used to permit the line to follow the rim more closely. With this done, the pottery is removed from the arc thus projected on the paper. On the arc draw two chords, and upon these chords erect perpendicular bisectors. The radius of the original vessel is the distance from the point of intersection of the bisectors to the arc.

The pottery piece is now fixed in erect position, resting on its rim, by driving wire brads to form inner and outer supporting rows. The cast reproduction of the pottery piece is placed on its rim, the latter resting on the line marking the completed circumference, opposite the true sherd. The next step is to model in the missing parts of the rim. This can be done in some cases by the application of thick plaster only. It may be necessary to model in clay the remaining spaces between the edges of the two pieces, and then build on either side a plaster mold which will overlap the edges of the pottery and the cast. The modeling clay will reconstruct the shape of the missing pottery, as indicated by the existing parts. Remove the clay after the plaster has hardened. Arrange the mold in a position so that the two pieces will be in their correct relative positions in the new mold, and thus add a cast that will make one solid piece of the original two. In many cases the missing parts of the vessel must be modeled in clay, and molds made, as in previously described instances. If the spaces to be filled are small, this can be effected from the outside by backing the opening with any kind of modeling material, filling in plaster, and finishing before the plaster is too hard.

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STANDARDIZED TERMINOLOGY

Dr. Ray's comments on greater accuracy in terminology, offered in the January issue of AMERICAN ANTIQUITY, are much to the point. I believe such a scheme as that which he outlines is at present being mulled over by various men in the field. Among others, Mr. M. R. Harrington of the Southwest Museum, and, unless I am misinformed, Dr. Arthur C. Parker of the Rochester Municipal Museum have been gathering data bearing on this problem. There have been several sporadic attempts in this direction, but few that have borne fruit.

There is a tendency among students new to the field to parrot expressions gleaned from previous publications without studying them. Moreover, they do not study specimen collections from the various archaeological areas, and

photographs, sketches or wash drawings of specimens are likely to be deceptive.

Then, too, each area has a certain number of colloquialisms that have crept into the professional patter, and these are perpetuated in "sacred" print, and so become accepted.

It seems high time to call a halt on the broad use of terms which have a limited value, or at best a purely local application. Thus, in the Southwest we have the word *olla*; I have no objection to the word as applied to a specific type of earthen jar, but to apply it indescriminately to all manner of earthen vessels, and at times to those made of stone, seems a bit unreasonable. Other words, such as *metate* and *mortar*, or *mano* and *pestle*, are confused by collectors and amateur archaeologists. Collectors use the word *arrowhead* without understanding the functions of an arrow. Some use a most arbitrary method of determining arrowheads and spearheads, such as length I have heard some collectors state that anything under two inches in length was an arrowhead, forgetting that bone arrowheads of the Eskimo may range up to ten or eleven inches in length; and the split-cane arrowheads from South America, even longer. Some of the bone arrowheads from the Plains are three or four inches in length, and a delicately fashioned stone arrowhead might well be over two inches in length, depending upon the length and strength of the bow in the particular area, the diameter and length of the arrow used, and the ability of the stone workers.

Going a bit further than Dr. Ray suggests, I should like to see a revision of terms; in other words, the compiling of an archaeological dictionary involving the discarding of those terms now in use which are not accurate or generally applicable. Mr. Harrington and I began such a classification. Some of the readers may not realize the difficulties involved in an attempt to define a stone axe, an arrow, or a bone awl in simple, easily understood language that could be accepted by the archaeologist in Maine, Alaska or Texas. True, there are many words now in use which could be retained, but the meanings would have to be clarified and standardized for all archaeologists. Pottery forms should be analyzed and a glossary of basic types drawn up. These could serve as common denominators. Each area would no doubt produce odd forms; in that case, the archaeologist would be free to add a local definition which would in no manner change the meaning of the basic form. In writing his report, he could preface it with his outline glossary, similar to that used by Drs. Kidder and Lothrop in *The Pottery of Costa Rica and Nicaragua*, Museum of the American Indian, Heye Foundation, Vol. I, pp. 109–110, New York, 1926. The dictionary, once compiled, might of a necessity undergo many revisions and editions as the science of archaeology progresses, but at least it would be a rock to which present and future archaeologists might anchor, and would bring about a greatly desired uniformity of language.

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NOTES AND NEWS

General

The History of Hawikuh, New Mexico, by Dr. F. W. Hodge, is to be the first publication of the Fund which bears his name, a fund being raised by voluntary contributions to commemorate his fifty years (1886–1936) in American anthropology. The purpose of the Fund is to publish works in the American field. Through the generosity of Dr. George G. Heye and the Trustees of the Museum of the American Indian, Heye Foundation, the initial publication will appear at no cost to the Fund. Dr. Hodge was on the staff of the Museum of the American Indian for 13 years, leaving it in 1932 to become Director of Southwest Museum.

Contributors to the Hodge Fund will receive a copy of *The History of Hawikuh, New Mexico*, or a credit toward its purchase, on the basis of one per centum of discount for each dollar contributed. This rate of discount will apply until the amount of the contribution is exhausted, the contributor paying nothing for Fund publications so long as a balance remains to his credit. A contribution of $50, for example, earns a discount of fifty per centum from list price. Fund publications will not be distributed gratis or exchanged.

This discount plan is made possible by applying all contributions to a capital fund, administered by the Trustees of The Southwest Museum Incorporated, of which the income alone will be used to finance the publication program. To date more than three thousand dollars have been received. Contributions should be directed to Hodge Fund, Southwest Museum, Highland Park, Los Angeles, California.

The Fund is under the guidance of the following Sponsoring Committee:

H. B. Alexander, Franz Boas, Herbert E. Bolton, Fay-Cooper Cole, Carl E. Guthe, Edgar L. Hewett, Aleš Hrdlička, A. V. Kidder, A. L. Kroeber, Jesse L. Nusbaum, Bruno Oetteking, Elsie Clews Parsons, Edward Sapir, Frank G. Speck, A. M. Tozzer, Henry R. Wagner, Clark Wissler.

Attention should be drawn to the quarterly entitled *Maya Research*. This quarterly dedicates itself to all such studies that pertain to the Maya area, i.e., Southern Mexico, Yucatan, British Honduras, The Republic of Guatemala and the Republic of Honduras.

In *Maya Research* are presented articles by the leading Maya scholars on explorations and discoveries, architecture and hieroglyphs. There one will also find hitherto unpublished documents from many archives, descriptions of the Maya country, and articles relating to the Maya of today.

Maya Research was first issued under the auspices of the Alma Egan Hyatt Foundation of New York (Vol. I, Nos. 1–2; 1934;—Vol. II, Nos. 1–4, 1935) and is now issued by *Maya Research* Inc., Station 20, New Orleans, La. Its editor

is Frans Blom, Director of the Department of Middle American Research of Tulane University. Subscription is $5.00 per year.

Southwest Area

The Arizona State Museum is now established in its new building and has entered upon a more healthy and vigorous stage in its existence. The building is in Lombard Romanesque style, 140 by 76 feet in size. The basement contains three classrooms (one of which is a large lecture room), a storage room, a preparation room, a laboratory, a darkroom, a fumigation room and a seminar library, besides the offices of the teachers in the department of archaeology. Under the entrance stairway is a large vault, 36 by 15 feet. The main floor is given up entirely to the display of the collections, with an alcove office for the assistant in the museum. This hall has a high ceiling and is surrounded on three sides by a mezzanine floor 16 feet wide. A steel railing runs around the front of the mezzanine floor and down the staircase to the lower floor. The whole building is well heated, lighted and ventilated, and has been built at a cost of about $80,000.

The regular summer field course in archaeology was again carried out at Kinishba, near Fort Apache. The ruin is extensive and interesting and provides excellent opportunity for good training in field work under healthy and interesting conditions.

The course in dendrochronology has been better stabilized and will henceforth be given under the auspices of the Department of Archaeology with Dr. E. A. Douglas as professor and Harry T. Getty, A.M., as instructor. Field workers from other institutions desiring material checked under the supervision of Dr. Douglas may send such material to the department at the University of Arizona. The institution will be glad to take care of any of this work and render such assistance as they can find it possible to grant. All know that Dr. Douglas is the great authority on this line of interpretation, and he is glad to give such aid as he can to wider application of the methods that he has created.

Plains Area

Mr. A. T. Hill, working for the Nebraska State Historical Society, has enjoyed an extremely successful season in the protohistoric Pawnee villages on the Loup River. Work was carried on at four different village sites and a total of twelve houses opened. The work has borne out Strong's characterization of this period as the heyday of Pawnee culture in the Plains. Besides supplementing Strong's material, a number of new finds were made which give additional leads to the sources of Plains culture. Outstanding among the new items are two types of bone arrowheads, bundles of charred cane which must have been brought into the region from the south or southeast, bone bows (?), and various types of woven containers.

Dr. Waldo R. Wedel's work in central and eastern Nebraska was cut short

after three weeks of very rapid investigation. Since he began this survey by gathering up loose ends in districts which already were more or less well known, he doubts that he secured very much in the way of new information. However, he was able to place on record nearly one hundred sites of various periods and culture divisions, including no less than seven sites yielding Woodland pottery types. At the time this report was received, Mr. Hill was preparing to investigate, so far as his limited man power and funds might permit, one of these Woodland sites which lies ten feet below the present ground surface, under a small terrace. It was planned to carry on investigations at this site for from one week to ten days, after which Mr. Hill was taking the party on to the Elkhorn River.

Wedel reports that he has records of and has seen pottery from two sites in northeastern Kansas, in the vicinity of Junction City, which seem to indicate Woodland affiliations. There is also a mound site from which have come curved-base monitor pipes and potsherds which are suggestive of Hopewellian.

We hope to have for the next issue an authentic report covering the summer season's work of the University of Nebraska under the field direction of Dr. Earl H. Bell.

Northern Mississippi Area

The University of Wisconsin-Milwaukee Museum Archaeological Expedition, under the supervision of Dr. Ralph Linton, and the personal direction of W. C. McKern, has just brought to a successful close the second season of research in northwestern Wisconsin. Two sites were investigated: a camp site and group of small mounds in Barron County, and a large village site and mound in Burnett County.

At the latter site a mound thirteen feet in height and seventy feet in diameter was found to have the same cultural origin as a similar large mound excavated last summer, reported in this journal I, 2, pp. 157–8. Four strata of secondary burials, each marking original placement over the surface of one of a series of four successively superposed mounds, the fourth stratum covered with a fifth and final mound, and two inclusive sub-floor pit burials were found to contain the remains of a minimum of one hundred seventy-five individuals. The primary disposal of the dead had probably been on scaffolds.

Burial units included the bones of from one to fifteen individuals. Evidence remained that at least a number of these units had been placed on, or wrapped in bark, and red ocher had been deposited with a majority of the burials. Triangular projectile points, trianguloid scrapers and one intact pottery vessel were found with the bones.

The most important discovery in this mound was the complete skull of a horse found associated with one of the burials. This was clearly an inclusive feature, and dictates a protohistoric or early historic date for the erection of the tumulus. However, the absence of any trade objects of European proveni-

ence, or any other indication of contact with white traders, renders it difficult to ascribe to the mound an age under two hundred years. It is highly improbable that the horse could have been introduced into Wisconsin from the northern Plains earlier than two hundred fifty years ago. The time limitations so defined point definitely to the Dakota Sioux as the authors of these relatively large northwestern Wisconsin mounds.

The Barron County excavations produced additional evidence in support of the Hopewellian classification of the Red Cedar River focus. Newly determined traits for the complex include: rectilinear burial pits with marginal embankments; artificially prepared gravel floors in mounds, the first to be reported for Wisconsin; the Trempealeau focus type of chipped-stone dagger.

Southeastern Area

For two weeks during the latter part of June, the Archaeological Society of North Carolina sponsored a preliminary excavation of a village site in the Piedmont area of North Carolina, under the direction of Mr. Joffre L. Coe. The site is located among the Uharie mountains on a small stream called Caraway Creek.

During the process of excavation, seven burials and a number of refuse pits were found and excavated. The burials, in all cases, were in pits varying in depth from six to sixteen inches. The individuals were fully flexed with the knees drawn up against the chest, and in the majority of cases the arms were folded with the hands resting against the face. Two of the seven burials were infants. With one there was found two small strings of disc-shaped cut shell beads, one string placed at the neck and the other at the wrist. One of the adult burials had two discoidals or game stones placed on the top of the skull. At its feet was a string of bird-bone beads spaced with pendants made from the scapula of a small animal. The beads range from three to five inches in length.

In one of the refuse pits there was found a number of broken and charred human bones mixed with a large quantity of animal bones. Also in direct association with the bones there was found a number of glass trade beads, trade pipe stems, beads of native origin, and potsherds. This apparently is evidence of canibalism within historic time.

The purpose of the excavation was to determine if possible whether or not this site was the location of the historic village of Keyauwee. The finding of trade articles in refuse pits proves the site to be historic. However, the lack of data on house construction and the lack of evidence of a wooden palisade to compare with John Lawson's description leaves some doubt as to the identification of the site, and until more work has been done this site cannot definitely be identified as the historic town of the Keyauwees.

Middle American Area

The "Folsom" Horizon in Mexico

The "Folsom culture" has not yet been traced much if any farther south than its type site; the search for it in northern Mexico by J. Alden Mason and

Robert H. Merrill, under a grant from the American Philosophical Society (this journal, July, 1936, p. 55), proved fruitless. While it cannot be claimed that men of the Folsom culture did not inhabit the regions explored, the evidence is against it. From the city of Durango explorations were made and many caves partly excavated northward to Guanacevi, west to the crest of the Sierra Madre Occidental, south to Chalchihuites, and in several localities eastward to the city of Monterrey, but no certain evidences of Folsom, or of any pre-pottery culture were obtained. Nor were any specimens of Folsom-like projectile points found. Collections of arrowheads are not common in this region; the children take little interest in them, and their elders find them too well suited for striking fire for them to be long preserved.

Northern Mexico

The great stretch of territory between the general region of Mexico City and the United States border has too long been neglected in view of its importance in the question of Mexican and Southwestern United States archaeological relationships. In the last few years a little reconnaissance and a few pieces of more solid work have been done, but the surface is yet little more than scratched.

Pushing south from Arizona and New Mexico, we have neglected to report the important work of E. B. Sayles in Chihuahua for Gila Pueblo of Globe, Arizona. This work was begun in 1933 and a report on several seasons of work has recently been published (*An Archaeological Survey of Chihuahua, Mexico;* Medallion Papers, XXII, May, 1936). Without wishing to usurp the functions of the book-reviewer, it might be pertinent here to summarize the findings. The archaeology of Chihuahua, or at any rate that of the parts of the state investigated, show little or no connections with the south. In the east are found camp sites; in the north, village sites with walls of puddled adobe, adobe and stone, or pure stone; and in the western mountains, typical cliff-houses. The second region, that of Casas Grandes, is the most important and interesting.

Gladwin's deductions are that there were three principal phases, the Medanos, Babicora, and Ramos. The earliest or Medanos phase is derived from a source of Mogollon affinities in southern New Mexico. The second or Babicora phase was probably a result of influence or migration from the Mimbres; this influence produced the stone-wall structures. The last or Ramos phase, the typical Casas Grandes, was the result of the migration of peoples of the Salado culture from southern Arizona; these latter built the large adobe houses with walls up to twenty feet in height, and the cliff-houses. The temporal periods of these three phases ran from 1000 to 1450 A.D. The trend of culture in this region was, within the periods examined, always from north to south, and the Pueblo frontier has thus been carried 400 miles south of the border. No influences from southern Mexico were found, and few if any from the ancient non-Pueblan Hohokam people. The peoples of the cultures and phases involved probably belonged to the Caddoan or Keresan linguistic groups.

Attacking the same problem from the south, Mason and Merrill, in connection with their search for Folsom man, examined surface sites as far north as Guanaceví, Durango. This is close to the Chihuahua border, only about 350 miles, air-line, from Casas Grandes, and apparently only about one hundred miles south of the southern border of the Medanos phase as given by Sayles. Around Guanaceví they found no surface sites, but only twenty miles farther south is the unjustly famous site of Zape. The pottery sherds of this site, in their opinion, show no relationship with Pueblan ceramics, and seem to be rather a peripheral debased phase of the Chalchihuites culture, the type site for which is two hundred miles to the southeast. Many of the sherds seem to be of the same colors and slips, the designs more roughly made, and a few of the fragments seem to have been the legs of tripod vessels, one of the diagnostic criteria that distinguish true Mexican from true Pueblan ceramics. It would be interesting to have the Zape sherds examined by a Southwestern ceramicist, and the Medanos sherds by a Mexicanist, and more important yet to investigate the intervening region.

The investigations of Mason and Merrill, both as regards the above work and other phases, were reported in the last issue of this journal. Work was continued in the same general region during March and April, with results that in no important respect alter the statements there made. Some time was spent on the crest of the Sierra Madre Occidental northwest of Durango City. No cliff-houses were seen or heard of in this region, although they are common farther north in Chihuahua. The little pottery found was of a poor quality with no evidence of any decoration. No masonry was seen anywhere, but in two places surface sites, with small low parallel mounds and a low flat open space between them and at both ends, were seen which recall in general shape ballcourts. The stone ax-heads in all the regions visited are grooved and more Southwestern than truly Mexican in appearance. The culture of these high mountains must have been generally low and without much if any connection with that of Chalchihuites.

After this an excursion was made south to Chalchihuites, and several intervening sites examined; for instance, a large one at Villa Antonio Amaro. Naturally the closer one gets to Chalchihuites the more the pottery resembles that of this type site. No groups of mounds such as characterize that site were found, nor any pre-Columbian masonry, but there must be other sites resembling Chalchihuites in this region.

Turning northeastward, all traces of the Chalchihuites culture have disappeared by the time one reaches the city of Torreon, in a much more arid region in which agriculture must be virtually impossible without extensive irrigation. While great engineering works have made this the largest cotton-producing region in Mexico, the pre-Columbian populations must have been on a purely hunting plane. No surface sites were seen, and little pottery. On the other hand the caves of this region have afforded fine textiles and twined bags that suggest a culture akin to Basketmaker.

A number of groups of petroglyphs of different types were observed by the expedition. Throughout almost the entire region visited, cliffs and rock-shelters were found with rude symbols painted in red; it seems probable that these are relatively late and made by nomadic peoples. One of the largest groups seen was near Covadonga, Durango, near the summit of a dominating peak; these have already been described in print by Pablo Martinez del Rio. Near Zape were observed a number of rock carvings, of a type heretofore unknown, on vertical cliffs close to a stream. The elements are relatively large, isolated, carefully made, and generally enclosed in rectangular boundary lines like cartouches. Near the town of Parras in Coahuila between Saltillo and Torreon, a large number of petroglyphs were found carved on the red rocks of a steep exposure; these superficially resemble more the petroglyphs of the American Southwest. The most unusual petroglyphs found were in the perfectly dark interior of one of the caves near Torreon. A few of these are incised, many painted in white, and a few of very peculiar type, heretofore unknown to the investigators, are small and carefully made, consisting of a black painted background on which the designs, often naturalistic, are filled in with small white dots of a thick substance.

Possibly the institution most active and interested in the problems of the terra incognita of northern Mexico is the University of California; the activities of the Ibero-Americana group there have to date been concerned almost exclusively with that region, and especially with the very interesting and important area of the Pacific Coast. Before they began their work, practically nothing was known of that great stretch of almost a thousand miles from Tepic to the American border, and their researches have disclosed several heretofore unknown culture types of a considerable degree of advancement. The latest work in that region is that of Isabel Kelly, of which a brief note was given in the last issue of this journal.

Miss Kelly dug at two sites, one near Culiacan, and one at Chametla near Rosario, both in the state of Sinaloa. The excavations were made in mounds which are accumulations of refuse on dwelling sites; no architectural remains were found except for one floor with post-holes. Burials were found in these mounds, secondary interments within large ollas, which have afforded materials for measurements of about one hundred individuals from Culiacan. No textile remains were found. No metal occurred in the Chametla series, and at Culiacan, only in the latest cuts. Elaborate clay pipes were found throughout the Culiacan range, but only temporally late at Chametla.

"The material secured is almost exclusively ceramic, of surprising variety and good quality from such a marginal location. The local chronological situation seems to be pretty complicated, but a fairly neat and convincing sequence has been worked out. Fortunately the material from the two sites overlaps, and late Chametla wares are equivalent to early Culiacan. From this it would seem that the Chametla series falls short of Conquest times and that we have yet to discover the earliest mounds in Culiacan Valley.

"The problem of external ties is pretty tantalizing. There is no apparent resemblance to the so-called Tarascan wares, but Tozzer's Coyotlatelco ware is strangely reminiscent of our Red rim decorated. On the whole, the Plateau is barren of even suggestive resemblances. The southern ties (the superficial resemblances to Costa Rica and Nicaragua—JAM) are, as is to be expected, generic rather than specific. The whole coast, from Sinaloa southward, is terra incognita, with plenty of opportunity for local variation. I (Miss Kelly) hope in time to visit this stretch of coast, if only for surface reconaissance. At present my hunch is that there is a real break between highland and coast; and that a, tongue of high culture, originating ultimately in the Central American region, spread northwestward along the coast plain as far as Culiacan valley."

Mason concurs fully with the last conclusions of Miss Kelly; as mentioned elsewhere in this report, he found no evidences of any high culture in high cordillera which separates these coastal sites from those of the Chalchihuites culture on the eastern side of the mountains.

The South Central Plateau

The recent work of the Direction of Prehispanic Monuments of the Mexican Government is given below in a report, translated almost verbatim, from Dr. Éduardo Noguera of the above Direction, and entitled "Archaeological Explorations Begun in Mexico up to August, 1936."

"The year of 1936 has been distinguished by the great number of new discoveries of archaeological objects that has been made.

"In the City of Mexico, on the grounds of the old Volador, in making excavations for the foundations of a new edifice for the Supreme Court, a small prehispanic platform was found in the center of the square. This platform had a stairway, and its interior contained an enormous offering of more than a thousand pottery vessels, a large part of them beautifully decorated in polychrome and of artistic shapes. The most important feature is that many of these vases came from regions far distant from ancient Tenochtitlán, which indicates that they were brought as offerings or tribute.

(The Volador Market is the local name for the "Thieves' Market" of the tourists, a name unrecognized by Mexicans; it lies immediately south of and across the street from the National Palace. The space occupied by the platform was small, possibly not more than fifteen or twenty feet square, and of only about four or five feet height; the staircase on the west side consisted of five or six steps. In this small space, to the rear of the staircase and in the earth between its upper and lower steps, the vessels were found in almost incredible number and compactness. All were buried in upright position and about half of them were excavated unbroken; the remainder, cracked by earth pressure. The majority seemed to me pure late-horizon Aztec. These data are from visual memory—JAM.)

"On the side opposite to the staircase, in the eastern part, a sort of pit was found which contained a stone box holding stone beads and ornaments of

shell, and on the box lay a statue of Huehueteotl, the Fire God. This indicates that all the offerings had some relationship with the (ceremonial) game of Volador (pole-swinging), which ceremony was formerly performed on this site.

"In the month of July a tomb of the purest Zapotec style was found in Tehuacán in the state of Puebla. The most interesting feature is that a large part of the contents belonged to the Teotihuacán culture. Furthermore, the discovery of this tomb in Tehuacán indicates a geographical extension of the Zapotec culture much farther to the west than had heretofore been observed.

"The explorations of the (buried) structures have been continued at Cholula, and a central tunnel has just been completed which pierces the entire pyramid from north to south. This permitted the discovery of the oldest section of the buried structures of Cholula which was found towards the center of the pyramid. It is made of a material much inferior to the rest of the edifices of this city, and is of a more primitive architectural style. Possibly this most ancient section was in part constructed by peoples of the Archaic culture, a possibility that must be verified by future explorations.

"Stratigraphic excavations were also continued at Cholula; these have demonstrated the presence here of the important cultures of this part of Mexico: the Archaic, the Toltec or Teotihuacán, the Cholultec, and various minor phases of these cultures."

Another important discovery was made in Malinalco in the State of Mexico. This is a monolithic temple, made of one piece, carved in the solid rock of a hill that dominates the town of Malinalco. Within the temple were sculptures of eagles and jaguars carved in the rock. This is the first discovery in Mexico of a temple of this character.

"Investigations were also intensified at the ruins of El Tajin, the famous pyramid with niches (in the state of Vera Cruz), and here new structures of a special type of architecture were found. Stratigraphic excavations have also been inaugurated which should supply new data for a better understanding of the archaeology of Mexico.

"At Monte Alban the excavations have been continued, with special attention to the North Platform of the so-called Sunken Court (Patio Hundido). On edifice J, fifty-one stelae were found. This structure is of a peculiar shape and may have served as an astronomical observatory. Also the front of the great South Platform was explored, revealing a wide stairway and walls. The exploration of the Ball-Court was completed, as well as that of several tombs with rich contents.

"With regard to archaeological work in the Maya region, restorations of the edifices have been continued in Chichén Itzá, Yucatán, and at Palenque. At the latter site stucco ornaments of great archaeological value were found."

Carl C. Dauterman of the Newark, N. J., Museum, who assisted Alfonso Caso in his work at Monte Alban the last season, has supplied a little further information giving the high-lights of that work. More than one hundred tombs have now been explored, many of them stratigraphically related to other struc-

tures; one contained several Zapotec polychrome vessels. Mound J, the probable observatory, differs in construction and orientation from all the other buildings of the Main Plaza. The fifty odd carved stones are of the "Dancers" type and bear inscriptions, some of them the first complete Zapotec dates to be found; many new glyphs are contained in these. Other "Dancers" carvings were found in the base of the South Platform and near the Temple of the Dancers. Five superb jades were found, two of them figurines. A Mixtec painted bowl with tripod support was discovered in a shallow crypt. It contained four copper chisels and a piece of carved bone. Associated with this were unpainted Mixtec vessels. An urn found under the floor of Mound I contained twenty-five greenstone figures. A "florero" or pottery vase of Teotihuacán manufacture was found with a burial. Vertical shafts through two large mounds further confirmed the tentative classification of pottery epochs established at the end of the previous season. These were found to check with tomb stratigraphy. A large cruciform chamber resembling those of Mitla was found, but the roof had fallen and the interior had nothing of interest. The first authenticated piece of Totonac sculpture for the Zapotec area was found near the above-mentioned burial.

The extensive and important archaeological excavations made by Alfonso Caso at Monte Alban and Mitla, Oaxaca, in 1934–1935, are described in two recent publications of the Instituto Panamericano de Geografía e Historia, with headquarters in Mexico City; the former work is Publication 18, 1935; the latter, number 21, 1936. The fifty-six plates and five maps of the Monte Alban report give an impression of the magnitude of the site and its excavation and reconstruction, as well as of the objects found. The features presented in this report include the Sunken Court of the North Platform, Mound B, the Central Mounds, Mound L, the Ball-Court, Mound X, the Tombs of the North Side, and the Tombs in the Mixtec Zone. The Mitla report also contains a large number of maps and plates. The main purpose of this work was to ascertain, if possible, the relation of Mitla to Monte Alban. In the South Group two tombs were discovered, one of a type like those of the fourth epoch at Monte Alban, and one related to the third epoch. This South Group seems to be the oldest section of Mitla, the edifices on the other side of the river being more recent and probably dating from a period after the abandonment of Monte Alban by the Zapotecs on account of the irruption of the Mixtecs into the Valley of Oaxaca. The greater part of the work consists of a description of the eight tombs and their contents, together with that of 64 test-pits made by Caso and his assistants.

George C. Vaillant of the American Museum of Natural History continued his researches in the Valley of Mexico, in which work he was as usual assisted by Mrs. Vaillant. Of late, his excavations have been more concerned with the later periods than with the Archaic. He has discovered another key to the

chronological relationships of Aztec pottery. Probably the most important ceremony of the Aztecs was that celebrating the beginning of a new 52-year calendrical cycle; then all idols were thrown away and replaced, the temple furnishings renewed and the temples refinished, and new fire was made. Dr. Vaillant has discovered and identified some of the dumps resulting from this wholesale discard. He reports, "Our own work consisted of completing our excavations at Chiconauhtla (this journal, Oct., 1935, p. 161), and in carrying out two subsidiary excavations at Nonoalco and another at Texcoco, in the group of mounds called Los Melones. The chief result of our work was to establish tentatively the correlation between Aztec pottery types and the ceremonial dumps at the close of each 52-year cycle. We have been able to isolate the dumps for 1507 at Chiconauhtla and Nonoalco, the dumps for 1455 at Chiconauhtla and Texcoco and a dump which must represent 1403 at Chiconauhtla. The discovery of fixed chronological points with which to link the elaborate stratigraphical series obtained by the various excavations of the Mexican Government and ourselves is highly significant, since by trade pieces and tentative cross dates of this nature from other regions there seems to be every evidence that the traditional historical material from Mexico is substantially correct even so far back as the legendary founding of the Toltec Empire. It is especially interesting to see how closely the architectural material from the diggings of the Mexican Government at Tenayuca correlates with our ceramic data from Chiconauhtla, Nonoalco and Texcoco insofar as these aspects of field archaeology are capable of reflecting the historical events detailed in the chronicles."

The important researches of Sigvald Linné and Gösta Montell of Stockholm, Sweden, which were briefly noted in this journal for last October, p. 164, are succinctly condensed in an article in the new Stockholm anthropological journal *Ethnos*, I, 2, March, 1936, pp. 39–48. They spent from October, 1934 to May, 1935, inclusive, in Mexico. This was the second recent trip of Linné to Mexico, the results of his first trip in 1932 having been published in his admirable work *Archaeological Researches at Teotihuacán, Mexico*, 1934.

Excavations were prosecuted near the town of Chalchicomula in the State of Puebla. In the neighborhood are nearly fifty mounds of earth, often in what appear to be intentionally planned groups. These mounds are either circular or square at the base, and often stepped and dressed with stone. Almost all of these had been rifled and partly destroyed by commercial excavators, but Linné trenched one which was over one hundred feet in diameter at the circular base and about twenty-five feet high. Thirteen graves were found in the process of this excavation, the individuals buried in either recumbent or sitting postures. The crania had been artificially deformed in the same manner as that employed by the Maya. The grave furniture was remarkably scanty but of importance since it shows no trace of Teotihuacán culture, an entirely unexpected feature; its aspects relate more closely to the Archaic cultures of the Valley of Mexico. Neither were any of the thousands of potsherds picked up on

the surrounding surface of Teotihuacán type; the deduction is that the contacts with the Teotihuacán culture were very superficial, if any, with the presumption that the ruins date from an earlier period.

Subsequently excavations and investigations were pursued again at Teotihuacán, close to the eastern boundary of the ancient town and near the church of San Francisco Mazapan. In all, one hundred forty rooms and three courtyards were exposed. Over two hundred pottery vessels were found in one grave, together with fragments of textiles and coiled basketry. A considerable quantity of Aztec ceramics was found, in contrast to the results of Linné's excavations in 1932 at the nearby site of Xolalpan where Aztec material was rare, but very few objects of the so-called Mazapan culture, which is post-Teotihuacán but pre-Aztec. Together with objects of the Teotihuacán culture were found others from more distant regions, some fragments of Maya pottery and others of a pure Totonac type, some of the latter resembling closely ware from the Isla de Sacrificios near the city of Vera Cruz. The importance of these finds of Teotihuacán, Aztec, Maya and Totonac pottery at one place can hardly be overestimated. The temporal relationships of the many types of Maya pottery are coming to be fairly well understood, and a study of these Maya sherds at Teotihuacán may afford a key to the problem of the relative sequence of Toltec and Maya periods. Mexicanists should await with interest a more detailed study of these. The rooms excavated were dwelling houses of the best Teotihuacán period, the first secular building to be investigated at this site.

The third archaeological investigation to be carried out was at the town of Calpulalpan in the state of Tlaxcala. A brief note of this work appeared in this journal a year ago. Linné was here assisted by Mrs. Helga Larsen and Miss Bodil Christensen. Three ancient groups of mounds, probably originally temple-crowned pyramids, were found. Some floors and walls were uncovered. The objects recovered were relatively abundant and in the main identical with objects from Teotihuacán. Several graves were found, in one of which was the beautiful mould-made bowl with high-relief decoration referred to in our last report. In addition to the four human figures there are four animal figures representing animals of the Aztec day-signs, and on the base is a figure of the rain god Tlaloc. "A study of these may enrich our scanty knowledge of the pantheon and calendar of the Teotihuacán people."

We deduce from a note in the last issue of the JSAP, signed "J. S.," that M. Jacques and Mme. Georgette Soustelle pursued archaeological and ethnological investigations in the Sierra Gorda region of the states of Queretaro, Guanajuato, Hidalgo and San Luis Potosi in November and December, 1935. The region abounds in archaeological sites. Coastal influence is strong, and fragments of Totonac stone yokes are found there. The pottery seems to be of two types, one of obvious Teotihuacán nature, and another apparently of local origin which displays no evident connection with any well-known Mexican ceramic.

Though it is technically outside the Middle American field, all Mexicanists should be made aware of the fact that two rather typical "ball-courts" have now been discovered in Arizona. One near Snaketown was excavated in 1934 by Gila Pueblo of Globe, and in 1935 the Museum of Northern Arizona, under J. C. McGregor, excavated an oval field near Flagstaff. In both of these courts are detailed features that connect them with Mexican ball-courts. Two other courts are known near Flagstaff, and probably by this time one of these has been excavated.

The Maya Area

A. V. Kidder of the Division of Historical Research of the Carnegie Institution of Washington has kindly supplied the following report of the archaeological researches of that Institution in Middle America during the past season:

YUCATAN. H. B. Roberts and H. E. D. Pollock continued a joint study of the ceramics and architecture of northern Yucatan upon which they have been engaged for a number of years. The work of the past season consisted of an exploration trip into the Chenes country, and of minor stratigraphic excavations at Uxmal. At Chichén Itzá, Karl Ruppert excavated and repaired a small tau-shaped structure which forms part of the general Thousand Columns group. (This is an important little building, believed to have been a sweat-bath; see the report of Frank Cresson herewith—JAM.) J. E. Thompson made an exploring trip into Campeche and Quintana Roo, crossing the peninsula from west to east. He located and surveyed a very large new site called El Palmar, which contained a great number of stelae. The latter, however, were of such soft stone that the epigraphic results were relatively disappointing. Toward the end of the season, Thompson excavated at San Jose in northern British Honduras, checking up previous ceramic and architectural observations.

GUATEMALA. Robert Wauchope excavated for three months at Zacualpa in the Department of Quiche. This work was undertaken in order to gather data bearing on the large collection from Zacualpa which had been made by pot-hunters, and which is now in possession of Padre Rossbach at Chichicastenango. Wauchope's excavations resulted in the acquirement of a very large body of data regarding house structures and burial practices. He also found well stratified deposits yielding much information concerning the sequence of pottery types. O. G. Ricketson and A. V. Kidder excavated a mound in the great site near Guatemala City. As this site covers a number of different phases such as Miraflores, Arevalo, etc., it has been named by the Society of Geography and History of Guatemala, Kaminaljuyu. The mound investigated proved to contain a superposition of four pyramidal structures. Lying to the east were three pit tombs, the burial places of persons of obvious importance, as the skeletons were accompanied by lavish mortuary offerings of pottery and jade.

At Uaxactún, Petén, Guatemala, A. Ledyard Smith, assisted by Edwin M. Shook and others, completed the four-year excavation of the "Palace," Structure A-V, securing architectural sequences and some excellent pottery. Gustav

Stromsvik and his party, with the coöperation of the Honduras Government, recommenced researches at the ancient city of Copan in Honduras. He continued clearing the court and the famous Hieroglyphic Stairway, opened exploratory tunnels in the Acropolis and repaired Temple 22. He also performed the very desirable work of building a diversion dam to protect the Acropolis from further demolition by the river which had already carried away a part of it. Sylvanus G. Morley devoted his year to the completion of his monumental work upon "The Inscriptions of Petén," which we understand is now ready for press.

The sixth season at Piedras Negras by the University Museum, Philadelphia, was devoted principally to working out further details in temples and palaces. The most significant deductions refer to the cultural debt of this western Usumacinta site to the central and probably Elder Petén region. This debt is greater than has been supposed. Nevertheless, at least after the earliest period, Petén influences were met by transforming ideas originating locally or received on earlier time levels. Space permits mention of only one specific instance—a temple (Structure J-29) in all essentials typical of the famous Tikal buildings except for the temple room itself. This always had a reasonable room width and began with three doorways separated by nearly square piers. This chamber was later converted into a one-doorway room, in this respect like those of the central Petén, but at the same time as much of the exterior Petén design as was practicable was obliterated. The question arises if this elimination of doorways was for structural reasons connected with the introduction of a vaulted masonry roof, since in a third period the two missing doorways were restored, with new and heavier piers between them. The typical Piedras Negras rear sill, niche, column altar and ventilator, i.e. the functional apparatus, was part of the original design and persisted throughout.

Building stratifications greatly strengthened the hypothesis that Usumacinta architecture developed without the masonry vault or "Maya Arch," adding it at Piedras Negras in a middle period. Work in the palaces produced two new masonry thrones, adding a new variety to a long Usumacinta series. Excavations in the intriguing series of eight "Type X" buildings were strictly confined to establishing two remaining doubtful examples as such. Examination of modern Mexican highland buildings by Francis M. Cresson, Jr., assistant archaeologist, on his way home, as given below, in the opinion of some students has eliminated all question as to the sweat house function of these structures, as first suggested by Dr. Morley.

Two sub-temple trenches, added to those of former years, make it increasingly probable that elaborate tombs were not placed below temple floors in this region, in contrast to the Petén sites Holmul and Uaxactun.

Several pottery types, new to the site, were identified, most of them probably trade pieces and therefore of great potential value. One of these, a complete vessel, was datable with reference to the architectural series and can

be neither very early nor very late "Old Empire." Certain others are almost certainly late.

Three days were spent at Palenque, making certain studies on the architecture and the thrones there, and establishing without much question the presence of a ball court, near the palace, spotted on Maudsley's map by Mr. Cresson, where it is perfectly obvious. Ball courts were probably universal at important southern Maya sites.

The party consisted of Mr. and Mrs. Linton Satterthwaite, Miss Tatiana Proskouriakoff, architect, Mr. Cresson and Don Victor M. Pinelo, representative of the Guatemalan government.

The above report was supplied by Linton Satterthwaite, Jr., leader of the University Museum's Piedras Negras Expeditions since 1933. The next is by Francis M. Cresson of the same Museum, who accompanied the expedition for his second year.

Returning from Piedras Negras in July, a short stay at Mexico City gave opportunity for the examination of the temazcales or sweat houses at several nearby Indian villages. Similarities between the modern Mexican sweat houses and eight small stone structures at Piedras Negras prove conclusively that these Piedras Negras buildings were used for the same purpose. In both areas the outstanding features are a small room with a very low doorway; a fireplace, within or on one side of the building; and a surface drain, consisting of a sunken passageway through the doorway. In the Mexican temazcal, steam is produced by water thrown on heated rocks at the mouth of the fireplace, and the bather also washes himself with hot water. From excavations at Piedras Negras the sweat house can now be included among the traits at least certain of the Old Empire Maya; while the "tau-shaped" building excavated this year at Chichén Itzá by the Carnegie Institution of Washington is also undoubtedly of the same type.

On January 5, 1936, Dr. W. D. Strong left Washington for Honduras as leader of a joint archaeological expedition from the Bureau of American Ethnology, Smithsonian Institution, and the Peabody Museum, Harvard University. He was assisted in the field by Alfred Kidder II and Drexel A. Paul, Jr., from the Peabody Museum, and by Mrs. Kidder and Mrs. Strong. Establishing its base at Progreso, in the Ulua Valley, the expedition made stratigraphic excavations at several sites on the Ulua River. In March and April, Dr. and Mrs. Strong with Mr. Paul conducted excavations around the north end of Lake Yojoa, while Mr. and Mrs. Kidder worked on the Comayagua River. In May and June the entire expedition worked sites on the Chemelicon River, including the site of Naco first visited by Cortez and the early Spanish Conquistadors.

On the Ulua River excellent stratigraphic series were secured of the prehistoric polychrome pottery horizons. At Playa de los Muertos on the Ulua, these horizons, corresponding roughly to the close of the Maya Old Empire,

were found to overlay a much earlier living level marked by monochrome, polished and incised pottery. This earlier horizon, the Playa de los Muertos culture, had been discovered in 1929 by Dorothy H. Popenoe. The polychrome and the monochrome horizons were separated by from one to two meters of barren clay. Both were marked by evidences of habitation and burial. The oldest horizon is apparently closely related to the earliest known occupation levels in the highlands of Guatemala and probably to those of the valley of Mexico. At Lake Yojoa, which is being looted by commercial excavators, both graves and house floors were uncovered. The association of various polychrome pottery types in the same graves was demonstrated, certain stone statues of the Nicaraguan Lake type photographed, and, at one place, a clear case of stratification of polychrome over monochrome pottery was discovered. Near Santa Rita on the Comayagua River, a splendid series of polychrome wares bearing evidences of a combination of Old Empire Maya and Chorotegan influences was uncovered. On the Chemelicon River, sites containing Ulua River polychrome pottery were mapped and partially excavated. At Naco, a ceremonial ball court was discovered and partially excavated, as well as numerous plaster-covered mounds and painted house floors. Some porcelain of early European provenience was found in association with the native ceramics. The latter, characteristically having a white slip and geometric red designs, represents a unique type for this region and may be of late Nahuatl origin. The expedition returned to the United States early in July.

The Antilles

Dr. Froelich G. Rainey and Mr. Irving Rouse of the Peabody Museum, Yale University, excavated in eleven camp and village midden sites in the vicinity of Fort Liberté, northern Haiti, last spring.

Five of the camp sites contained no pottery. In these sites flint was almost the only material used for artifacts. The majority of the artifacts found were large flaked-flint implements, with shapes suggesting use as knives, spearheads, or daggers. Some of them resemble flint tools found in Harrington's Ciboney and Tainan sites in Cuba. Similar flint implements were also found in the Fort Liberté sites containing pottery, but in these sites they formed only a small porportion of the total kinds of artifacts.

Two of the sites contained pottery resembling that known to have been used by the Indians of Santo Domingo in Columbus's time. This is the kind of pottery usually found in Haiti and the Bahamas, and it is characteristic of Harrington's Tainan sites in Cuba. The pottery from the remainder of the sites resembles more closely that found by Krieger at San Juan village site on the Samaná Peninsula in the Dominican Republic, the pottery described by Fewkes from Cueva de las Golondrinas, near Manati, Puerto Rico, and the pottery excavated by Dr. Rainey from intermediate levels of certain middens in Barrio Canas, Barrio Coto, and Barrio Monserrate, Puerto Rico.

No red and white painted pottery, such as that found in Puerto Rico and

the Lesser Antilles, was found in any of the Fort Liberté sites. All of the sites excavated contained marine shells, unlike some of the sites which contained painted pottery excavated by Dr. Rainey in Puerto Rico.

As yet, there are no direct indications of the relative ages of any of the sites, as no natural stratigraphy occurred.

The above report is from Cornelius Osgood, Director of the Peabody Museum of Yale University. A fuller report of this work appeared in the Proceedings of the National Academy of Sciences, 22, 1, January, 1936. Both this and Rainey's former work in Puerto Rico on the "Crab-Culture" are of the greatest importance and open up new problems in the Antillean area.

Many important publications in the Middle American field have appeared within the last year, of which it would be unfair to mention those that come readily to mind, and laborious to try to tabulate all. In addition to those mentioned above, the publications of the Carnegie Institution, the American Museum, the Maya Society, Ibero-Americana, the Mexican National Museum, Maya Research, El Mexico Antiguo, Ethnos, the University Museum, and the Guatemala Sociedad de Historia include the majority of them. Sven Loven has published an enlarged English edition of *Origins of the Tainan Culture, West Indies*, and *The Conquest of Yucatan* by Frans Blom has recently appeared. The bibliography for the Maya area is very completely covered in *Maya Research*.

BOOK REVIEWS

New Evidence Relating to the Archaic Occupation of New York. WILLIAM A. RITCHIE. (Researches and Transactions of the New York State Archeological Association, Vol. 8, No. 1, Rochester, 1936.)

Mr. Ritchie has reported on the excavation of two sites in western New York State. One, the Geneva site, is characterized by a deposit of homogeneous black earth, one to two feet in thickness, through which was scattered the debris of occupation. This deposit overlaid an old sod line. The second and smaller deposit, Scottsville, is characterized by a number of fire or cooking pits which had been left on the level top of a glacial kame.

There is no doubt that the artifacts found on these two sites belong to the same culture horizon and that they are practically identical with the Archaic Algonkin which was discovered by Mr. Ritchie at Lamoka Lake. With these discoveries we are presented with data which confirm Mr. Ritchie's hypothesis that there existed in New York State a people who used rough, chipped, and certain types of polished stone artifacts together with many types of bone implements. That these people did not use pottery, steatite, gouges or grooved axes appears to be fairly well established.

This work which Mr. Ritchie is so ably conducting under Dr. Parker's direction is adding considerably to our knowledge of eastern archaeology. By means of this investigation the author isolates a number of diagnostic traits of the Lamoka focus of the Archaic pattern (formerly called by him the Archaic Algonkin) and traces, to some extent, their distribution. Of particular interest to those of us who are working with eastern archaeology are the three types of chipped points with narrow blades and straight or notched stems associated with other definite types of stone and bone work. As has been implied in this paper, evidence is slowly accumulating to the effect that on the Atlantic littoral a similar stone industry prevailed. With the gathering of further data, which will make possible a definition of this coastal industry, it is obvious that Mr. Ritchie's careful work will be of considerable aid in evaluating it.

One of the most important aspects of this definition of the Lamoka focus is the discovery that gorgets, bannerstones, birdstones, grooved axes and gouges are missing in the Archaic pattern in New York. Since the "traditional" ideas of eastern archaeology have included particularly gouges and bannerstones, we are extremely interested to discover an early eastern horizon which does not include these types. As a matter of fact, if one is permitted to prognosticate such things, we will not be surprised if a similar situation is found to prevail along the coast as well as in New York State.

Because of the technical problems involved in excavation in the East, it would have been advantageous, though not necessary, if the author had included in the paper a section-drawing or a photograph of the deposits which

were found. From a selfish point of view it would be desirable to have some such illustrations in order to compare them with our own. I heartily commend Mr. Ritchie and Dr. Parker for their willingness to drop the term "Algonkin" from the archaeological vocabulary. As Speck pointed out a few years ago, this term is purely a linguistic one and its use in archaeology has led to much confusion.

FREDERICK JOHNSON

Ceramic Decoration Sequence at an Old Indian Village Site Near Sicily Island, Louisiana. J. A. FORD. (Anthropological Study No. 1, Department of Conservation, Louisiana Geological Survey, 39 pp., 5 plates, 12 figs., New Orleans, 1935.)

In this first paper of the new series instituted by the Louisiana Geological Survey, Mr. Ford presents the results of his analysis of pottery forms and decorations found at the Peck village site near the Ouachita River northeast of Natchez. Four ten-foot square sections were excavated at this site, a level floor being maintained in each section and the material from the different levels segregated. The average total depth of the sections was about 20 inches. The ceramic types from each level in the different sections were classified according to an index previously developed by Mr. Ford from a study of sherd collections made in Mississippi and Louisiana.

This index is really a list of decoration types and the classification is summarized in the paper now being reviewed. According to this scheme of classification, the decorated sherds at the Peck site fall into three main groups, the *Marksville*, *Coles Creek*, and *Deasonville*, while unusual decorations not definitely belonging to these groups form a fourth type. Actually, the unclassified sherds of this latter type are relatively uncommon and do not figure in the stratification analysis. Furthermore, examples of pottery designs of the Deasonville type were not particularly numerous, so the ceramic decoration sequence at this site boils down to the chronologic difference between the Marksville and Coles Creek pottery complexes. When the percentage of specific marker types of these two complexes in the various levels of the excavated sections are compared, the results very definitely show a high percentage of Marksville sherds in the lower levels with an increasing percentage of Coles Creek and a decreasing proportion of Marksville types in the higher and later levels. This indicates that, at this particular site at least, the Marksville type of ceramics was gradually replaced by that of Coles Creek. Although the Marksville type is very probably older, it does not follow that Coles Creek developed out of Marksville, for there is no evidence of such evolution.

Pottery of the Marksville type is very similar to that found in Hopewell sites of Ohio, but most of the other characteristic features of this culture are not known at present in the southeastern states. It seems likely, however, that when sufficient evidence accumulates so that prehistoric cultural relations can

be worked out with some degree of definiteness, the distribution of the Hopewell culture will be found much wider than is now supposed.

The chief interest of Mr. Ford's paper is its presentation of a method of pottery decoration analysis and the determination of sequences where no definite stratification exists. For this reason it should receive the attention of those who may not be specifically interested in the local archaeology it describes but who may have problems whose solution can be aided by the methods outlined by Mr. Ford. The paper forms an excellent introduction to the new series and it is to be hoped that the Louisiana Geological Survey will continue the publication of their Anthropological Studies.

FORREST E. CLEMENTS

SOME RECENT PUBLICATIONS

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